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OVERSIGHT

H.R. 5158—TELECOMMUNICATIONS ACT OF 1982

ORIGINAL

HEARING

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SEVENTH CONGRESS

SECOND SESSION

JUNE 9, 1982

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OVERSIGHT

H.R. 5158—TELECOMMUNICATIONS ACT OF 1982

WEDNESDAY, JUNE 9, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C.

The committee met pursuant to notice, at 9:36 a.m., in room 2318, Rayburn House Office Building, Hon. Don Fuqua (chairman) presiding.

Present: Representatives Fuqua, Glickman, Wirth, Shamansky, Bouquard, Nelson, White, Winn, Dunn, Skeen, Gore, Hollenbeck, Gregg, Schneider, Sensenbrenner, and McGrath.

Mr. FUQUA. The committee will be in order.

Today the Committee on Science and Technology will turn its attention to one of the world's premier industrial research institutions, the Bell Telephone Laboratory.

Since its founding over 50 years ago, Bell Labs has produced an unending succession of important R. & D. contributions to the telecommunications field. These have ranged from basic discoveries for which Bell scientists have received seven Nobel Prizes to a host of innovative product developments. Innovations such as microcircuitry, fiber optics and electronic switching have resulted in better and cheaper service to telephone customers.

But Bell Labs has also played a much broader, national role. Some of its work, such as Dr. Penzias' discovery of background noise from the "big bang," has influenced fundamental scientific thinking. Other developments, such as the transistor, while initially directed at telecommunications, have found application in many other industries.

As the House committee charged with overseeing the health of research and development in this country, we regard the labs as an important national asset. This is especially true today when Government-sponsored civil research is coming under increasing budget pressure.

Yet these are times of both great opportunity and uncertainty in the telecommunications industry. New technology, greater competition, and regulation change have all combined to create unsettled conditions.

Of particular interest to this committee is the effect on Bell Labs. Both the proposed antitrust settlement between A.T. & T. and the Justice Department and the pending Telecommunications Act of 1982 may impact the labs' traditional way of doing business.

The purpose of these hearings is to examine that impact and its influence on the posture of R. & D. in the United States.

At this time, I would like to recognize Mr. Glickman, who is chairman of the Transportation, Aviation and Materials Subcommittee and one who has had a particular interest in not only communications R. & D. but also the Bell Labs.

Mr. Glickman?

Mr. GLICKMAN. Thank you, Mr. Chairman.

I would like to just make a couple of points. I think the chairman has adequately stated the reason for these hearings. They do not exist in a vacuum. Not only are we interested in Bell Labs because they are, if not the largest, one of the largest private research institutions in the world, with over $1.5 billion worth of R. & D. funding, but becasue the fact of the matter is, based upon my review of both the divestiture issue and H.R. 5158, those items could have a very significant impact on the ability of Bell Labs to do research and development and therefore, in an indirect way, for the United States to compete with companies like Nippon Electric, the Germans, the Japanese generally, in terms of fiber optics, communication, and related things.

If that is so, we may be pursuing a very dangerous path by going full speed ahead on a deregulatory environment which may lead us into a position where the United States is less competitive with the rest of the world than we were before.

I would like Dr. Penzias, in his testimony, if possible, or during the questions and answers, to deal with the issue which was raised in a letter by Timothy Wirth, chairman of the Communications Subcommittee, to Frank Press, in which he says:

> Unlike legislation passed by the Senate last year, H.R. 5158 does not require a split of Bell Labs to separate regulated from unregulated activities. Instead, Bell Labs is completely unregulated other than for minor accounting requirements and is free to pursue any activities it chooses.

It may be that the statement is technically true, but what we may end up with in both H.R. 5158 and the divestiture is a free company with no funding base. And if that is what you end up with, then you might as well not have a Bell Laboratories, and that worries me very much.

And so, Mr. Chairman, I am delighted to have the opportunity to be here and look forward to the statements of the gentlemen from not only the Bell System but the other witnesses as well.

Mr. FUQUA. Thank you, Mr. Glickman.

Without objection, Mr. Winn has a statement that will be made part of the record.

[The prepared statement of Mr. Winn follows:]

HONORABLE LARRY WINN, JR.
ON THE IMPACT OF TELECOMMUNICATIONS ACT ON
THE BELL LABORATORIES

JUNE 9, 1982

MR. CHAIRMAN, I WANT TO WELCOME OUR WITNESSES BEFORE THE COMMITTEE TODAY. THE ISSUE WE WILL DISCUSS IS AN IMPORTANT ONE WHICH MAY HAVE A VERY PROFOUND IMPACT UPON TELECOMMUNICATIONS RESEARCH.

THE BELL SYSTEM IS EXTREMELY UNIQUE IN THE COMMITMENT THEY HAVE MADE TO THE ENTIRE SPECTRUM OF RESEARCH FROM BASIC TO APPLIED TO SYSTEM DEVELOPMENT. THIS COMMITMENT HAS RESULTED IN CREATING A TELEPHONE SYSTEM WHICH IS UNSURPASSED FOR RELIABILITY, EFFICIENCY AND COST. MANY TIMES IN THIS COMMITTEE, WE TALK ABOUT THE IMPORTANCE OR RELEVANCE OF INVESTING IN RESEARCH TO THE LONG TERM HEALTH OF AN INDUSTRY; THE BELL SYSTEM HAS DEMONSTRATED, VERY EFFECTIVELY, THAT RELEVANCE.

NOT ONLY HAS THIS BEEN GOOD FOR THE COMPANY BUT MORE IMPORTANTLY IT HAS BEEN GOOD FOR SOCIETY AS A WHOLE. THIS IS A PERFECT EXAMPLE OF THE WAY IN WHICH TECHNOLOGY CAN BE APPLIED TO IMPROVE THE QUALITY OF LIFE. IN MY OPINION, NO OTHER FORM OF TECHNOLOGY HAS HAD A BIGGER IMPACT ON SOCIETY THAN TELECOMMUNICATIONS. IT HAS MADE THE WORLD MUCH CLOSER. THIS WOULD NOT HAVE

BEEN POSSIBLE WITHOUT THE INTRODUCTION OF NEW TECHNOLOGIES SUCH AS MICROCIRCUITRY, COMPUTER SWITCHING AND FIBER OPTICS.

AS YOU CAN PROBABLY DETECT I AM VERY IMPRESSED WITH THE TELEPHONE COMPANY IN SPITE OF THE FACT THAT THEY MAY BE THE ONLY ONE IN TOWN. I AM PHILOSOPHICALLY A VERY STRONG ADVOCATE OF COMPETITION AND DEREGULATION. BUT, I ALSO SUBSCRIBE TO THE PHILOSOPHY -- "IF IT AIN'T BROKE, DON'T FIX IT".

THERE IS A STRONG POSSIBILITY THAT, INADVERTANTLY, THIS MAY BE THE CASE WITH H.R. 5158 RELATIVE TO THE BELL LABORATORIES. IT WOULD BE A CRYING SHAME IF WE WERE TO DISRUPT AN INSTITUTIONAL STRUCTURE THAT HAS SERVED SOCIETY WELL.

I HOPE THAT THESE HEARINGS WILL CLARIFY THAT ISSUE. AND, IF IT IS THE CASE, PERHAPS WE CAN MAKE ACCOMMODATIONS FOR POSSIBLE CHANGES IN THE ACT.

THANK YOU.

Mr. FUQUA. We have asked Congressman Wirth, who is chairman of the Communications Subcommittee of the Energy and Commerce Committee, to join us in these hearings today. He is also a member of this committee but on leave of absence while he serves on the Budget Committee. I would like to ask Mr. Wirth if he has any comments to make. We are pleased to have him here today.

Mr. WIRTH. Thank you very much, Mr. Chairman.

I am very pleased to be here. As a member of the Science and Technology Committee on leave to the Budget Committee and chairman of the Communications Subcommittee, I am pleased to have this opportunity to hear the testimony today and to clarify, from the perspective of the Communications Subcommittee, any misunderstandings that may have arisen related to H.R. 5158, of which there are more misunderstandings than reality, let me say.

Bell Labs is clearly a very valuable national resource, and I can speak for the other 14 members of the subcommittee who joined me in unanimously approving H.R. 5158 in March, when I say unequivocally that the bill does not interfere with the labs' capability to continue its major role in enriching our Nation's technologicial development through basic research.

I suspect that those who have concluded differently have read only isolated pieces of the legislation without considering the whole. In any event, the Telecommunications Subcommittee staff is currently meeting with representatives of A.T. & T. to resolve any possible legitimate language misunderstandings on that score.

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Unlike legislation that passed the Senate last year, and which Senate legislation was supported by A.T. & T., H.R. 5158 does not require a split of Bell Labs or of Western Electric. I point out again, Mr. Chairman, that last year A.T. & T. supported legislation which split Bell Labs and split Western Electric. Neither split is in H.R. 5158, the House bill.

Instead, Bell Labs remains intact in H.R. 5158, completely unregulated, other than for minor accounting requirements, and is free to pursue any activities that it chooses.

There has been some confusion about funding sources that will be available, and I heard that discussed as I came in this morning. Let me try to clear up that confusion.

Historically, almost half of the labs' funding has come from license contracts between the Bell operating companies and Bell Labs. Those contracts terminate under the proposed antitrust settlement, which was agreed to by A.T. & T. and the Justice Department. Those contracts and that funding therefore terminate. A.T. & T. agreed with that, and the Justice Department; that was not something that the Congress legislated. That would leave Western Electric and Long Lines as the A.T. & T. in-house source of funding.

H.R. 5158 does not alter the status quo with regard to Long Lines' or Western's ability to fund basic research at Bell Labs. We do not interfere with Bell Labs, Mr. Chairman.

I might also point out, Mr. Chirman, that after 7 years of saying that we ought to have legislation, A.T. & T. has done a sharp 180° turn and is now trying to kill the legislation and is now trying to get across all kinds of misrepresentation and fear about what is in H.R. 5158.

We are in the process of going to full committee markup at the end of next week, and I think it is fair to say that once people actually read the bill, not what A.T. & T. is putting out about the bill but read the bill, they will find out that it is a very rational bill. It is going to pass the full committee, I believe, by a very significant margin in a couple of weeks. I think people are more afraid of A.T. & T. and what they say than they actually believe what A.T. & T. is saying.

So I appreciate being here, Mr. Chairman. Thank you very much.

Mr. FUQUA. Thank you, Mr. Wirth.

Our witnesses today will be Dr. Arno Penzias, the vice president for research at Bell Labs. He will be followed by Dr. John Gibbons, the director of technology assessment. He will be followed by Dr. Richard Lamon, past president of the IEEE.

So, Dr. Penzias, we are happy to hear you this morning, and we will be pleased to hear your testimony.

I understand you are accompanied by Mr. Keefauver, who is counsel to the Bell Labs.

Dr. PENZIAS. Right.

STATEMENT OF ARNO PENZIAS, VICE PRESIDENT FOR RESEARCH, BELL LABORATORIES, ACCOMPANIED BY WILLIAM L. KEEFAUVER, VICE PRESIDENT AND GENERAL COUNSEL, BELL LABORATORIES

Dr. PENZIAS. Thank you very much, sir.

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I am very pleased to be here this morning and to present Bell Labs' view.

I understand there is some time pressure. In any case, I presented the committee with a written statement outlining contributions that we have made but, more important, the unique climate that has made those contributions possible, as well as the impacts on that climate which we and I see in H.R. 5158.

It seems clear to me, Mr. Chairman, that my understanding of those impacts is at variance with the views expressed by the bill's principal sponsor, Congressman Wirth.

As Congressman Wirth said this morning, and as he did in the letter to the New York Times yesterday, essentially that: "in no way, it," meaning the bill, "interferes with Bell Labs' structure or in any way threatens its basic research capabilities" I cannot agree with that.

In my written testimony, I have cited specific sections which I believe would interfere with essential funding and vital information flows.

I can read, for instance, section 251(c)(5) in no other way than prohibiting the joint funding of research by Long Lines' and A.T. & T.'s unregulated entities. To me this is very upsetting.

In the past, research has been funded by the Bell operating companies, by Long Lines and by Western Electric. With the divestiture of the Bell operating companies, it is essential to me and to research that A.T. & T. have the ability to pool funds from all available revenue streams to be able to continue a broad-based research program, and 251(c)(5) prohibits such pooling.

Now, I am not insensitive to cross-subsidy concerns, and I believe that all organizations that benefit from an activity should pay their fair share. I should point out, of course, that the benefits from that activity flow in different directions; that is, the operating entity receives benefits from this cohesive, synergistic operation, as well as the manufacturing entity.

The problem is that what appear to be only minor accounting rules to other people would force me to fit my research into predictable boxes and track each of those boxes in ways which I just cannot do without distorting the work that would have to be contained in those boxes.

I am concerned about the requirement that Long Lines and Bell Labs would have to enter into a contract for research which would: "be carried out in the same manner as business conducted with unaffiliated persons."

Now, Congressman Wirth, in a recent letter to Chairman Brown of A.T. & T., stated this required a contract: "which in price and terms meets the standards of an arm's-length dealing," unquote. Now, if this means that the transactions be appropriately cost compensatory and that Long Lines and Bell Labs document the transactions between them for Commission review, this requirement would not be troublesome. However, the vagueness of the language, especially as applied to research, does trouble me. I am not a lawyer, but I have read those words and I have consulted with Mr. Keefauver for explanations and, as I understand it, I am left with some concerns.

Section 223(a)(3) poses a different type of problem. It permits the allocation to Long Lines of the costs of applied research but: "only to the extent that such costs benefit the carrier subsidiary." Now, such a provision is certain to have a chilling effect on long-term, risky research.

It is very hard for me to envisage doing research for which I might have to give a refund if it is unsuccessful. The clear word "benefit" in there makes it unlikely that risky things can be funded in the normal way that we are used to.

Section 252(a) and (b) strikes at the very heart of our innovation process, namely the free flow of information. It is one thing to require the prompt disclosure of newly adopted protocols and technical requirements for interconnection, but this section goes much farther and can easily be interpreted to interfere with any information exchange relating to technical requirements. But almost everything we do relates to technical requirements.

Finally, the market restrictions in the bill are likely to have a long-term damping effect on any enthusiasm for funding a wide-ranging research program. If there are businesses which the funding entity cannot get into, it does not encourage them to fund those things as they have in the past.

In conclusion, Bell Labs can continue to provide the Nation with a valuable research and development resource. However, to continue its traditional research program, it needs both its freedom to support research by funds from all revenue streams and, equally important, the freedom to exchange information freely among research, development, manufacture, and service-producing organizations.

Also, A.T. & T. will be most likely to continue its support—and that is a point you made, sir—of broadly based R. & D. programs—and I need that support very badly—if it is free to follow the results of its research efforts into the marketplace.

That is a brief opening statement, and I would be very happy to answer questions, and perhaps we can discuss this further.

[The prepared statement of Dr. Penzias follows.]

U.S. HOUSE OF REPRESENTATIVES

COMMITTEE ON SCIENCE AND TECHNOLOGY

STATEMENT OF
ARNO A. PENZIAS

ON BEHALF OF

BELL TELEPHONE LABORATORIES

JUNE 9, 1982

Mr. Chairman and Members of the Committee:

My name is Arno Penzias. I am Vice President of Research at Bell Laboratories.

I appreciate the opportunity to testify on the subject of Bell Laboratories' research and the effects that H.R. 5158 would have on that research and on the process by which its results are transformed into extremely productive and innovative technologies.

Before commenting on those effects, I would like to provide a few views on research in general and its conduct at Bell Labs.

Knowledge and its organization

I know that this Committee, and indeed all of the Congress, is greatly concerned about the health of research in the U.S. and its relationship to technological innovation. This is an important concern because, as is widely recognized today, we in this country live in what has been termed a "knowledge-intensive" society. It has been estimated that over the past few decades, at least two-thirds of our economic growth has been due to advances in knowledge. This new knowledge and its organization and application increasingly determine our well-being in a world where new information and high technology play key roles in our health, national security, and economic growth and competitiveness.

I should stress at this point that it is not some isolated research effort that accounts for these advances, but the entire process of generating the new knowledge, organizing it and applying it in the most useful, productive ways. When this integrative process is carried out successfully, new knowledge becomes our most powerful resource, one which can add value to all others and greatly increase our economic strength.

Perhaps a classic example of this value-added aspect of research and its applications is the silicon-based integrated circuit. This powerful and still evolving technology was pioneered by Bell Labs. We learned how to grow a thin layer of precisely defined crystal on a bulk substrate, then change its properties by implanting specific atoms within it, and to then use special lithography to connect the resulting devices by the application of electrical conductors and insulators. The successful realization of this technology required the cooperative efforts of people from more than a dozen scientific, engineering and manufacturing disciplines. It provides the basis for many of the most dramatic technological benefits of our age -- and we have barely tapped its potential.

Perhaps the best example today of how successful a nation can be by effectively organizing and managing new knowledge is Japan. As a small, resource poor country, knowledge is Japan's principal commodity. And the key to their success has been to organize it and use it to turn the natural resources they must import into profitable export items.

It is vital that we in the United States recognize and make the maximum use of organized knowledge. And this must go beyond the conventional concept of research and development as isolatable entities to include the entire process of innovation, which requires the transfer of technologies into useful, marketable and profitable products and services.

We must be able to do this particularly in high technologies if we are to maintain our nation's economic strength and competitiveness. For with all our inherent strength in natural resources and human talent, we should recognize that we do not have a monopoly of either. Other advanced nations are challenging us in many technological fields. And many other countries in the process of modernization have comparative advantages in labor costs and natural resources that give them a competitive edge in some traditionally manufactured products.

Therefore, it is essential that we support, encourage and improve the best that we have in the way of our scientific and technological capabilities. And that we pursue the best ways to organize and integrate them into important innovations.

I believe that over the years the Bell System has provided an outstanding example of technological integration in which all elements of the innovation process are related to each other in a way which optimizes the generation and organization of new knowledge into services and products useful to the public.

And not just new knowledge generated by us since we recognize that Bell Labs is part of a larger community. Our publication and patent policy makes our research results widely available for others to use and assures us of the timely availability of new knowledge generated by others. In particular, our research compliments the research work of the universities to our mutual benefit. Thus, we are able to draw upon, organize and apply new knowledge generated by all parts of the scientific and technical community.

Contributions of Bell Labs

Bell Labs has made many important contributions to science and technology. I am convinced that a principal reason for our success has been integration of the innovation process. A major contribution of that process has been toward creating the world's finest telecommunications system. That system is still evolving with the help of Bell Labs innovations to meet the nation's growing communications needs. And it is a system well noted for its reliability. I think it is essential to point out that in an age of increasing dependence on complex technologies, we are one of the pieces that works -- and works well.

But Bell Laboratories' contributions extend far beyond telecommunications. Its inventions and innovations have been key to all electronic technology. As Fortune magazine in an article on innovation has pointed out, of the 17 major innovations in the semiconductor electronics field, 12 came from Bell Labs.

With microelectronics cited as a technology that will be key to future economic growth worldwide, I believe we at Bell Labs have an important role to play. That role involves using intellect -- our most precious but renewable resource -- to fuel the economy. That resource, however, is only renewable under certain conditions. And it thrives only in a certain environment. I would like to discuss this next, in terms of the potential impact of H.R. 5158 on Bell Labs' research.

Freedom and Focus

To do this let me begin by telling you why I believe our research mission at Bell Labs has worked successfully in the past. Two essential ingredients have been responsible for our success; freedom and focus. These have not been conflicting forces but synergistic ones. We have had the freedom to be able to work long-range on a broad range of problems, and to do so with the knowledge of continuing support. This assurance of continuity of funding is essential to research that is promising but cannot produce results on demand.

At the same time we are not an Ivory Tower institution. We are an integral part of an organization that has a specific mission and specific needs, and we share a two way flow of information with other parts of that organization.

In sum, our success has been due to the fact that we enjoy a steady level of support and a broadly defined scope of responsibility, and this support has been provided in a

technologically integrated and intellectually interactive environment. Alsc, our people benefit from identification with successful application of our work and from getting to know about the problems and opportunities as seen by people with day-to-day involvement in our business.

I know it is recognized by this Committee, and all in Congress who have studied the matter of innovation, that many new ideas and inventions come from small businesses and from individual inver cors. The common wisdom is that the best of these are then "brought up" by larger firms who have the capability to develop and market them.

We at Bell Labs have not had to resort to this process for our new ideas. Because of those elements of freedom and focus I mentioned before, we have this proverbial "small business" spirit at work inside our Labs -- scientists and engineers who successfully embody an inventive and entrepreneurial spirit because they have the support, information and motivation to do the job with a minimum of stifling bureaucratic impediments.

H.R. 5158's Impact on Research Support and Integration

How does the framework of H.R. 5158 impact upon this type of synergism, this approach to the integration of scientific research and technological requirements? As I read the provisions in the bill, they would prevent it. Since 223(a)(3), for example, requires that the carrier bear the costs of applied research "only to the extent such costs benefit the carrier subsidiary." An item-by-item cost justification requirement of this kind

shatters the relationship between Bell Labs and Long Lines, and effectively eliminates the type of risky, long-range research Bell Labs does best and this country needs most.

Section 243(b)(1) of the bill further requires that common or exchange carriers shall not pay an affiliated manufacturer for any cost of research or development of any facility, except as contained in a contract for the purchase or lease of such facility.

As I understand the bill's wording with respect to these two provisions (and I do have trouble with them), this means I would not have obtained funding to build the antenna that allowed me to win the Nobel Prize.

I see many such "bear traps" in this bill. A provision in H.R. 5158 that is most damaging to the future research of Bell Labs lies in Section 251(c)(5) of the bill. The restrictions in this section would keep the carrier subsidiary and unregulated portions of AT&T from joining in Bell Labs programs of basic research. These are just the programs which, over the years, have been fundamental to the nation's leadership in high technology. Because this section prevents sharing of the cost of research by Long Lines with anyone else it would isolate Long Lines' research from any other research.

As I see this bill, it results in fencing us in with a manufacturer. And I think it is essential to point out that the reason we at Bell Labs have a broad charter is that we are

not funded solely by a manufacturer. While we also depend upon the contribution to research support provided by Western Electric, I should stress that a manufacturer's research support is strongly tied to short-term economic conditions and fluctuations and is normally restricted in scope as well. The vital research freedom I spoke of earlier requires that we continue to be connected to an operating entity. However, H.R. 5158 subjects this relationship to drastic change. I cannot speak to the social and political reasons for this change. I can only speak to its technological consequences. And I see those as dire.

Perhaps the framers of H.R. 5158 believe that the manufacturer can and should pay for the whole cost of my research, but as I indicated before such an environment will not support the type of research that I and my colleagues do at Bell Labs and that I believe this country needs.

Fencing us in exclusively with a manufacturer creates an organization that does not work well for research. It would create the very type of industrial laboratory the Congress sees as failing to provide important needs of the American economy. It would change Bell Labs into just another industrial laboratory, while others the world over are trying to emulate Bell Labs. Does this make good policy -- or even good sense?

I am also disturbed by Section 252(a) and (b) of the bill which put information barriers between Bell Labs and Long Lines. Free flows of information are vital to effective

innovation, and legislated barriers could have far reaching and disastrous consequences.

Another concern I have is the potential long term impacts on research arising from the market restrictions imposed on AT&T by the bill, such as found in Section 264(c)(1) which invites Bell exclusion from providing AMPS a service long awaited by the public and for which technology has been available for over a decade. A manager's decision to fund broad research programs is bound to be negatively impacted in the opportunity to follow useful results to the marketplace is denied.

As I see it, this bill would do irreparable damage to a major asset of this country's R&D capabilities.

This is a very important time for us in the telecommunications industry and for the nation. And I would like to conclude with a few thoughts on this matter.

I think we all recognize that the size of our unmet needs in this country remain enormous. Telecommunications can contribute greatly to meeting those needs. And it can help do so based on an extension of the human intellect, instead of human drudgery and dependence on scarce fuels.

I think it fair to say Bell Labs is widely recognized as the world leader in this important effort. Ours is a capability it has taken decades to build and to nurture to its present state of excellence. I believe it is important to our nation that this capability be preserved and allowed to function at its proven level of efficiency. As a scientist I have learned to follow the old adage, "If it isn't broke don't fix it." Furthermore, I believe that our work continues to enhance the creative and innovative efforts of the many others engaged in the growing and competitive communications

and information fields.

At this time when the nation's economic health and position in world markets depends vitally on the advancement of its technology-based industries, such as those represented in the Bell System, I feel it is essential that the country develop and pursue enlightened and progressive policies for telecommunications. I have every confidence that the Congress will consider this important matter carefully, and in the light of such consideration act in the best interests of the nation.

ARNO A. PENZIAS

Arno Penzias is Vice President of Research at Bell Laboratories. He began his scientific career in 1961 when he joined Bell Laboratories as a Member of Technical Staff. He conducted research in radio communication and related areas, and also took part in the pioneering Echo and Telstar communications satellite experiments. As a scientist he is, however, better known for his work in radio astronomy, especially his part in the discovery of evidence supporting the "big-bang" theory of the origin of the universe, work for which he shared the 1978 Nobel Prize for Physics. Over the years he has held a number of managerial positions in Bell Laboratories Research and was recently named to his present position as Vice President of that organization. This responsibility covers a wide range of programs in the physical, material, communications and information sciences.

Dr. Penzias also maintains an active program of personal research. His recent work includes the study of chemical molecules in outer space, with particular emphasis on how the elements in these molecules are formed, as well as studies of the structure of our galaxy, the Milky Way.

He maintains close ties with the academic community, having been a member of Princeton University's Astrophysical Sciences Department since 1967, where he regularly acts as thesis advisor to graduate students. He is also an adjunct professor of Earth and Space Science at the State University of New York at Stony Brook.

Dr. Penzias' own college education began at the City College of New York where he received a Bachelor of Science degree in 1954. After two years of service as an officer in the U.S. Army Signal Corps, he attended Columbia University where he received his master's and doctorate degrees. He also has received a number of honorary degrees and is the only American to hold an honorary doctorate from the Paris Observatory.

He is a member of the National Academy of Sciences, as well as a number of other scientific and professional organizations. He also serves as an associate editor of the Astrophysical Journal, as Chairman of the Editorial Committee of the *Bell System Technical Journal*, and as a Vice Chairman of the Committee of Concerned Scientists, a national organization devoted to working for the political freedom of scientists in various countries.

January 1982

Mr. FUQUA. Thank you very much.

As I understand it, you are concerned that the regulated part, which would probably be the Long Lines, will not be permitted to fund basic research as they can do today. Is that correct?

Dr. PENZIAS. Yes, sir. Well, that they will not be able to fund it in the manner that they are able to do now.

Now, a part of this, as Congressman Wirth has just said, may result from a misunderstanding, because Congressman Wirth, for instance, in one of his most recent letters, refers to the words "basic research." The bill refers to "research" and to "applied research."

Now, at Bell Labs, we refer to research as an activity which is the organization of knowledge for a purpose.

Mr. FUQUA. Well, I think we could maybe clarify basic research from, say, product development.

Dr. PENZIAS. OK. There could be something which we would call research or basic research and something else which we would call product development which would be product-specific and have usually some kind of time schedule associated with it. That we would not call research.

What I am dealing with is research. Now, the research that we talk about, however, is not pure in the sense that there is nothing associated with it, no goal. It is certainly very directed. For example, 2 years ago when I was here, before two subcommittees of your committee, they were very concerned about the space program and that America was not spending enough money to build, to develop traveling wave tubes for satellites, and we were falling behind in the traveling wave tube business.

Well, I pointed out to the committee at the time that we were working on solid state replacements, making sufficiently good transistors that we could transistorize that thing and throw away those short-lived vacuum tubes.

Well, that work goes on today, Mr. Chairman. It goes on for the benefit of Long Lines, but we draw very heavily on knowledge we have gained from the manufacturer, Western Electric, which will ultimately appear in a product manufactured by Hughes Aircraft. So there is a flow in that direction as well, and that kind of information flow is prohibited, and the joint funding of that research is apparently prohibited.

By having one pool where the information can flow allows me to use information from wherever I can get it. What appear to be minor accounting problems to other people provide me with information barriers which cut down on that efficiency very badly. Long Lines could not get as good a product if I had not been able to have in that operation access to information which was originally developed or done for a manufacturer.

Mr. FUQUA. On page 134 of the consent decree, and I quote, it says:

> Most important, the proposed modification would terminate the license contracts under which research is funded in part by monopoly revenues. A.T. & T., like other firms, would thus be forced to fund its research and development from the sale of products and services in competitive markets. A.T. & T. will therefore have no inherent advantage over other firms in funding such research and development.

Now, how does the consent decree work?

Dr. PENZIAS. This is the modified final judgment?

Mr. FUQUA. That is what I understand.

How would that be different from what is in the bill as you interpret it?

Dr. PENZIAS. Because, in the wording of the final judgment, as I understand it, the Long Lines is referred to as a competitive unregulated entity, as I understand it.

Mr. FUQUA. Would not Long Lines be regulated by the FCC and local public service commissions?

Dr. PENZIAS. As I understand it, the modified final judgment says that this is supposed to be the unregulated portion of A.T. & T. and includes Long Lines. Am I not right on that?

Mr. KEEFAUVER. Perhaps I could help, Mr. Chairman. Under the modified final judgment, there is no reference made to regulation. That is left to existing statutes. In other words, the modified final judgment leaves the power of the regulatory bodies exactly where it is today.

Mr. FUQUA. Which would be the FCC and local public service commissions.

Mr. KEEFAUVER. Under the 1934 act, that would be the FCC for interstate and the PUC's for local rates.

However, the modified final judgment would permit A.T. & T. to tap whatever revenue streams it had available to fund whatever activity it chose, including research, and it could combine the funds from those various revenue streams in whatever way it chose to do, which would very likely be the way it does today. For basic research, it combines these various revenue stream taps, if you will, in a single pool of research.

Mr. Chairman, to respond to your original question, we view that section that Dr. Penzias referred to, 251(c)(5), as prohibiting that type of joint funding. We agree with Congressman Wirth that the bill does not prohibit Long Lines from funding research, but it would be a compartmentalized, stand-alone research, as we read the bill, and they could not pool their funds with the other activities to produce the resource capability which we presently have, which has both scope and size which we feel is necessary to maintain the type of program which has characterized our work over the years.

Mr. FUQUA. But the FCC and the local regulatory ratemakers do not now permit product development under the rate base. Is that correct?

Mr. KEEFAUVER. That is correct. We are not permitted and we do not use the funds from the license contracts to fund product development. Product development at Bell Laboratories is funded almost entirely by Western Electric. Some is funded directly by Long Lines. Indeed, over half of our funding is from Western Electric.

Mr. FUQUA. And that could continue under the bill and the consent decree?

Mr. KEEFAUVER. Exactly.

Dr. PENZIAS. It is only research which is fragmented, as I understand it, in this; that is, is changed drastically from its past practices. That is these sections 251(c) (3) and (5) that I was referring to.

Mr. FUQUA. Will there be any effect on the consent decree and H.R. 5158 on your national security work?

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Dr. PENZIAS. Only to the extent that if in fact research is crippled or in some way hampered, presumably, all of Bell Labs suffers to some extent; to the extent that Bell Labs is not as good a place, the quality of that work will be poorer, I assume. I think that we can say that the fact that there is good research going on at Bell Labs flows to the benefit of all parts of that organization, and if Bell Labs has to function in the future with a restricted and narrower research focus, then presumably the national security work that we do will also be in poorer shape.

Mr. KEEFAUVER. Mr. Chairman, there is an effect in H.R. 5158 on national security in fact which is not present in the modified final judgment, and that arises from the requirement under the bill that Long Lines be set up as a fully separated subsidiary with certain separation rules and certain restrictions on joint ventures.

Now, these restrictions are lifted for two purposes, international and national security work, as I understand the bill. But it is rather difficult for me to understand how you could have two separate organizations doing most of their business in separate pockets coming together somehow spontaneously to do work of these two specific types. It seems to me if you are forced to set those two organizations up as separate organizations, there is no way you could bring them together for a single purpose without fear of violating the separation rules for other purposes. Those violations are subject to civil action by another provision of the bill.

Mr. FUQUA. In the antitrust settlement and in the bill, how does it treat Bell Labs in relation to research arms of other telephone companies?

Dr. PENZIAS. I am truthfully not familiar with any other research arm of a telephone company in the United States which is as fully integrated as we are, so I don't think they would suffer in the same way, because this large-scale integration is just not there.

GTE, which has a research organization in its manufacturer, does not, to my knowledge, have the same kind of systems research that we do, so that there is not another organization like it to be treated this way.

Certainly the best of the foreign telecommunications organizations have something like what we do, and then we would be at a disadvantage with respect to them, of course.

Mr. FUQUA. Mr. Winn?

Mr. WINN. Thank you, Mr. Chairman.

Dr. Penzias, I guess you would probably be the best one to answer this, but either one of you could. I am interested in how A.T. & T. and Bell Labs decide how much to allocate toward basic research. How are the projects selected and what rate of increase has there been in the past few years?

Dr. PENZIAS. That is a very good question. Let me first talk about the size of research. Research at Bell Laboratories, which is the piece that I am responsible for, has grown at a rate of about 1 percent per year for the last decade or so. There is not very much growth. We have grown very slightly in size. We have attempted to increase the scope of our work by just being a little more efficient, but the size has been fixed, if anything, historically.

As for selection of projects, that is actually done largely on an individual basis as people in my organization see opportunities.

The larger management—A.T. & T. and our owners—do not interfere very much with research, except if occasionally I ask for large amounts of capital equipment for a particular project, then this is reviewed by the board of directors which has A.T. & T. members.

But beyond that, I am given a fixed pot of money, if you will, and asked to do my best, and the people in my organization work very well under this rather free environment.

Mr. WINN. Well, do you think that this might change after divestiture or after H.R. 5158?

Dr. PENZIAS. Well, I hope it will not change. I think it will not change as long as we are connected to an operating entity for our research support. If our research is supported only by a manufacturer, on the other hand, then I am afraid that this manufacturer will feel it appropriate to restrict the range of our research to things which benefit that manufacturer, largely.

The fluctuations which would come in the fortunes of the manufacturer's sales in a particular year would also modulate the size up and down. So the kind of research which we have been doing—when the chairman was at Bell Labs recently, for example, he met Al Cho, one of our scientists who is producing something which took him 14 years to produce. Now, a manufacturer will be very unlikely to fund something with that kind of long-range output. Even though it has been extremely beneficial, it is the kind of thing that we might lose if we work only for a manufacturer.

The manufacturer certainly should pay for a fair share, and Western Electric does support research to some extent. It is not a question of giving some of it, but if Western Electric were to give all of it, I am afraid that research would change a great deal.

Mr. WINN. Down through the years, Bell Labs has shared much technical information with the telecommunications industry. In your opinion, would this attitude be likely to change in this new competitive environment?

Dr. PENZIAS. Well, we have had an open publication policy for many years, and I would strongly urge that that policy be maintained, and I see no reason to doubt that if we continue our present structure, it will continue, because we benefit. It is a two-way flow. We are coupled to the rest of the scientific and technological community, and there is a two-way exchange of ideas and information, and as such we are treated very cordially when we need information because we also give it.

So I think that that will continue. We patent our work, and we license those patents, so we certainly want to benefit, and we want our owners to benefit from our research, but we do try to share this information freely.

Mr. WINN. Well, will H.R. 5158 have any impact on that past policy, or past practice?

Dr. PENZIAS. Well, if H.R. 5158 forces me to become solely a manufacturing-supported research organization, then I cannot speak for the long-term policy of that manufacturer. I would imagine that, like most manufacturing supported research, they are less free in their communication. If, however, we continue to be funded by an operating entity, if we have a large share of operating entity support in this pool of research, then there is much more likelihood that the policy which has served us so well, so long, will continue.

That is one of the reasons I need and have argued for the continuation of the present funding policy in my prepared remarks.

Mr. WINN. As I understand it—I am just trying to read into your comments there—it appears that basic research could be reduced.

Dr. PENZIAS. It very well could, sir.

Mr. KEEFAUVER. Congressman Winn, if I could supplement briefly Dr. Penzias' comments, one of the strengths of Bell Laboratories over the years has been its ability to attract world-class scientists to its ranks, and that ability depends very heavily on the freedom of researchers to publish their results.

Now, Chairman Brown, after announcing his agreement to the modified final judgment, stated unequivocally that he planned to continue the research program that we had over the years, and to me that means a research program of the type that we have been conducting.

Mr. WINN. How much money have you spent on basic research this year, would you say, or how much is in the budget for it?

Mr. KEEFAUVER. The total funds for research—and in that we include what we call both basic and applied but not development—I believe it is around $250 million. And even though we would lose a significant portion of that revenue, we feel confident we can find other revenue streams to support continuation of the type of program that we now have. It may be smaller, but we do not envision it would be substantially smaller or smaller to an extent where it would lose its essential characteristics.

But I believe that we would have to continue, and we would want to continue, this policy of open publication of research results. Otherwise, we would not be able to hire the quality of people that we need to support that type of program.

Mr. WINN. Thank you very much. Thank you, Mr. Chairman.

Mr. FUQUA. Dr. Penzias, we have a rollcall vote, and we are going to have to take a short recess to respond to that. We will be right back.

Dr. PENZIAS. Thank you, sir.

[Recess taken.]

Mr. FUQUA. The committee will resume.

The Chair recognizes Mr. Gore.

Mr. GORE. Thank you very much, Mr. Chairman.

I am chairing a subcommittee hearing that was scheduled some time ago on genetic engineering. Otherwise, there is nothing in the world that would keep me from this hearing, partly because of my deep respect for Dr. Penzias, whom I have come to know quite well and whose judgment I respect a good deal.

Dr. PENZIAS. Thank you, sir.

Mr. GORE. I also respect the judgment of all the other witnesses, Dr. John Gibbons, my fellow Tennesseean, who can really enlighten us on this issue, and Dr. Damon. And the second reason I don't want to miss this hearing is because I also serve on the Commerce Committee, which is going to very shortly be wrestling with the issues that are being discussed here in part.

I just wanted to pay my respects, Mr. Chairman, and get back to the witnesses that are waiting in the other room. I am sorry to miss your testimony, but I will read it carefully, Dr. Penzias.

Dr. PENZIAS. Thank you very much, sir.

Mr. Fuqua. Thank you, Mr. Gore.

Mr. Glickman?

Mr. GLICKMAN. Thank you.

The real question is what happened before the big bang, but I think we can probably discuss that later on.

Dr. PENZIAS. We will be happy to talk to you about that afterwards.

Mr. GLICKMAN. All right.

I would like to somehow get down for the record the differences between the funding for research before the divestiture, after divestiture, and after divestiture with the Wirth bill, because I think that we are talking about a lot of loose terms here. I think it is important to figure out specifically how this is all allocated.

As I understand it—well, why don't you go ahead and see if you can explain it.

Dr. PENZIAS. Basically, at the present time, research is funded in the way in which I responded to Mr. Winn, in that there are certain areas, and my area is given a certain amount of money by A.T. & T. which then I am free to spend, essentially almost entirely free to spend, in whatever way the science dictates.

Mr. GLICKMAN. OK, now wait. But you get money from Western Electric——

Dr. PENZIAS. No; I get some money from Western Electric, but the large portion comes, in my organization, from license contract money at the present time, which means from Long Lines and operating telephone companies.

Mr. GLICKMAN. Long Lines, and then the operating telephone companies provide you some funding.

Dr. PENZIAS. They provide, in fact, presently they provide the majority of my funds.

Mr. GLICKMAN. OK. Now, how will it be after divestiture?

Dr. PENZIAS. After the divestiture——

Mr. GLICKMAN. But assuming there is no Wirth bill.

Dr. PENZIAS. At that point, a certain part of that money, a large part of that money, is lost. That revenue is then presumably going to be made up by A.T. & T. to keep me in business.

Now, Chairman Brown has testified to a Senate hearing saying that is what he plans to do. So then the money in this funding source is replaced by A.T. & T. from its revenue sources, and its revenue sources will include Long Lines, it will include Western Electric, as well as many of these other organizations such as our international organization, and so forth.

Mr. GLICKMAN. Let me stop you for a minute. I understand that, after divestiture, Western Electric is basically spun off from—or it is kept by A.T. & T., but in terms of its regulation, it essentially becomes a part of the, quote, competitive as opposed to the regulated environment. The FCC is still involved with Long Lines' rate setting, but Western becomes more competitive with the IBM's of this world?

Dr. PENZIAS. Well, I think it becomes free of some of the restrictions of the 1956 consent decree.

Mr. KEEFAUVER. The main effect, Congressman, of the modified final judgment on Western Electric is, as Dr. Penzias just mentioned, the lifting of the business restrictions in the 1956 consent

decree. The modified judgment does not deal with the organizational relationship of Western to the new A.T. & T.; it leaves that to A.T. & T.'s judgment. It deals, however, with its freedom to enter these new markets.

Mr. GLICKMAN. OK, so before the consent decree, then, the amount or the component of the research dollar that came from the Long Lines or from A.T. & T. was basically determined by joint agreement between A.T. & T. and you.

Dr. PENZIAS. Yes.

Mr. GLICKMAN. Does the FCC have any input into how much was allocated on the rate base?

Dr. PENZIAS. Well, the FCC and the State regulatory commissions reviewed this contract, of course, as part of their ratemaking procedures. This is money which is coming from revenues of regulated entities. And so, over the years, our research is supervised in the aggregate by these regulatory agencies. People from the California Rate Commission, the FCC, and so forth, come to visit us regularly, see what we are doing, assess the benefit to the organization which is paying it, on a large scale. They don't insist that some MBE machine is appropriate, but they do check, and I assume that that fair share is properly looked after and will be in the future.

Mr. GLICKMAN. OK, now, the chief difference between your position and Mr. Wirth's position seems to be with respect to section 251(c)(5).

Dr. PENZIAS. In the case of funding. There are other differences, but in the funding, this is one of the places. This is one of the places.

Mr. GLICKMAN. And that section says any transaction between the carrier's subsidiary and other affiliates of the dominant carrier shall not have the effect of assigning or allocating the costs of any research, development, manufacturing, marketing, et cetera, to common carrier services.

Now, what I am trying to figure out is, in the case of funding, what specific impact will that have on your research?

Dr. PENZIAS. It means that, as I read this, and again I am not a lawyer, but I do worry about wording like this, it means that I cannot work broadly from one funding source from which to fund all my research because I am not sure in advance which piece is going to support or ultimately benefit which carrier, which funding entity.

What this forces me to do is break it into pieces, and that just is unrealistic as far as research is concerned. I am then left only with the unregulated portion to support me.

Mr. GLICKMAN. The unregulated portion meaning Western Electric?

Dr. PENZIAS. Well, Western Electric, ATTI, the other pieces, the unregulated pieces of A.T. & T. These are the manufacturing——

Mr. GLICKMAN. We are talking about, I guess, to some degree, some speculation. I guess what concerns me is what in fact will the impact be. Will it mean that you will be doing much more applied research than you do now, and that you will have far less generic basic research in which you have no specific product line in mind but you might have some general product lines in mind?

What I am trying to figure out is, tell me exactly what kind of project you could see yourself not doing in the future that you would be doing had it not been for this kind of language.

Dr. PENZIAS. Under this kind of language, I will not have the same freedom to do long-range speculative research because it is not clear who, if anyone, it will benefit. So, therefore, if I cannot get funding from the operating entity because there is no guarantee that it will benefit them and in fact the information flows to that area are sort of isolated, so it has to sit over by itself; then I am left having to go to the manufacturer for it, and the manufacturer has a much narrower focus and a much shorter-range focus, so I may not get the money there, either, for long-range, speculative sorts of things.

It may well be that some of our work in vacuum physics might not be funded. Certainly the speculative kinds of things we did in satellite communication don't seem to have a natural home in the new work.

Mr. KEEFAUVER. Excuse me, sir.

Mr. GLICKMAN. Go ahead.

Mr. KEEFAUVER. If I could, Congressman, suggest another specific example and see if Dr. Penzias agrees. We have no committee report, of course, on H.R. 5158, so we have to give these words the natural meaning we can derive from them, and although we have Congressman Wirth's letters now available and we find them encouraging, we still have to read these words as we find them, and it seems——

Mr. GLICKMAN. You realize the bill has not been reported out of committee yet, so there would not be a report.

Mr. KEEFAUVER. Exactly.

Mr. GLICKMAN. That is why we don't have a report.

Mr. KEEFAUVER. I am not being critical of the lack of a report; I am just stating it is a fact that there is no report.

Mr. WIRTH. I just think, just for the record, we ought to point out, if the gentleman would yield, that there is no committee report that comes with a subcommittee bill. It comes with a committee report, so I think it is really unfair for A.T. & T. once again to suggest that somehow we are delinquent in not having a committee report.

Mr. KEEFAUVER. Oh, no. I certainly had no intention of being critical, but the fact remains there is no report to explain the meaning.

But as we read the words, it says that Long Lines could not contribute funds to research which might benefit an unregulated part of A.T. & T., and I would suggest acoustics research, for example, which has been a hallmark of Bell Laboratories since its beginning, as a specific type of research.

Mr. GLICKMAN. All right, but let me get this clear. You are making the point that you do not believe, with the Wirth bill, that Long Lines could contribute to research that would benefit an unregulated part of the entity.

Mr. KEEFAUVER. Exactly. That is the way we read 251(c)(5).

Dr. PENZIAS. That is research which any portion could benefit from. Normally, when we do very forward-looking things, we are not sure that some portion might not benefit one side or the other.

That is what we hope for, as a matter of fact. We hope for synergy and broad application.

Mr. GLICKMAN. OK. I would like to just ask one final question. I have used up too much time, and this is very interesting. We need to spend a lot more time on this issue than we are doing right now.

Mr. Wirth made the point in his testimony about the historic position of A.T. & T. in terms of divestiture and the position of A.T. & T. now on divestiture as well as on the Wirth bill, implying that there were some inconsistencies there. I wondered if you might comment on that.

Mr. KEEFAUVER. Congressman Glickman, I would be pleased to respond to that comment. Congressman Wirth correctly noted that A.T. & T. had favored and encouraged—indeed, solicited—legislation for many years. But I would, sir, suggest that he is incorrect in stating that A.T. & T. has made a 180-degree turn and is now opposing legislation. A.T. & T. still favors legislation. It does not favor H.R. 5158 for many reasons which Congressman Wirth is familiar with.

They would like the legislation, of course, to take into account the activities in Judge Greene's court where this consent decree, which is a proposed modified final judgment, is currently under review and from which court we shortly expect a decision. And so I think it is completely incorrect to say that A.T. & T. has done a 180-degree turn on the desirability of legislation.

Second, on the acceptance of the modified final judgment, Chairman Brown has made clear over and over that that judgment was not our idea and that, all things being equal, we would have preferred business the way it was, but we see the situation as making that completely impossible. So the modified final judgment was accepted as a tradeoff.

As Chairman Brown mentioned, one of the tradeoffs that encouraged him to accept that judgment was that it left Bell Laboratories alone or left A.T. & T. free to deal with Bell Laboratories, fund it in whatever ways it saw fit, and that is one of our major problems with H.R. 5158; it does interfere with this funding.

Mr. GLICKMAN. OK. Who is your biggest competitor? Who is the Bell System's biggest competitor in the world in terms of building Long Lines, fiber optics, communications, those kinds of things?

Dr. PENZIAS. Japan, Inc.

Mr. GLICKMAN. Japan, Inc. That would be what, Nippon Electric? Would it be a lot of companies in Japan? Is that what you are saying?

Dr. PENZIAS. Not a lot of companies; the lot of companies, sir.

Mr. GLICKMAN. Implying what by that statement?

Dr. PENZIAS. That they have learned the value of organization and cooperation on a large and economic scale. They parcel out their activities in such a way as to take the maximum benefit of every brain they have in their country. I give them a lot of credit.

They are a poor country, very few natural resources. They are making it on brains and guts, and so they know what they are doing. They take the various jobs that they have to do and parcel them out among themselves. Their Government encourages them with funding, low-cost loans, and encourages that they and their universities get together in the optimum way to provide for opti-

mally competitive equipment which then attempts to be marketed in the rest of the world, and those are the people that we look to at the present time to be our most serious and most formidable competitors.

I think we can take them on. I think we have beaten them in a number of cases, but they are certainly not a pushover.

Mr. GLICKMAN. Are they in fact competing with the development of Long Lines and fiber optics and related things in the United States with the Bell System, Western Electric, particularly?

Dr. PENZIAS. Yes, sir, they are.

Mr. GLICKMAN. I see.

Mr. KEEFAUVER. As the Congressman may be aware, just recently, in a competitive bidding, the major bidders other than Western Electric were Japanese and European firms. As far as R. & D. peers are concerned, the major ones are in Europe and in Japan.

Mr. GLICKMAN. Thank you, Mr. Chairman.

Mr. FUQUA. Thank you.

Mr. White?

Mr. WHITE. I have no questions at this time.

Mr. FUQUA. Mr. Wirth?

Mr. WIRTH. Thank you very much, Mr. Chairman, and again, Dr. Penzias, we are very pleased to have you here.

Currently, what percentage of the support for Bell Labs comes from the Bell operating companies?

Dr. PENZIAS. Mr. Keefauver has been writing those numbers down. I think he probably has it right here.

Mr. KEEFAUVER. Currently, Bell Laboratories gets funding from the operating companies in two ways, one through the license contracts and about 28 percent of Bell Laboratories' 1982 budget is funded by license contracts. Now, that includes some Long Lines funding, also, I would point out.

The second way is through an agreement known as BIS for Business Information Systems, which is about 11 percent of Bell Laboratories' budget. Now, that also includes a Long Lines component. So the total component from the Bell operating companies, as distinguished from Long Lines, is probably in the order of 30 percent.

Mr. WIRTH. As I understand it, under the settlement that A.T. & T. and the Justice Department agreed to, there will no longer be that funding coming from the Bell operating companies to Bell Labs. Is that correct?

Mr. KEEFAUVER. That is correct. The license contract would terminate.

Mr. WIRTH. Have you, as a steward of Bell Labs, Dr. Penzias, protested that you are going to lose 30 percent of that funding?

Dr. PENZIAS. I certainly regret losing it. I and probably everyone else inside the Bell System would be much happier if we could do business as we do it today. One Bell system, I think, has served this country very well, but as Chairman Brown has pointed out, we no longer have that option.

I can live with the modified final judgment. I would rather not live with it, but the hole in my funding which that final judgment leaves me is one that Chairman Brown and the A.T. & T. Co. has pledged to fill.

Mr. WIRTH. But, for the record, you have not—excuse me.

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Dr. PENZIAS. I just wanted to finish. They have pledged to fill it. As I read the words in bill, the information I have, the ability to fill that hole in a way which would replace what I had is very much reduced, and the motivation to do so is reduced as well. That is why I am so concerned.

Mr. WIRTH. Just again, for the record, about 30 percent of your funding comes from the Bell operating companies, but instead of saying that may be a problem for Bell Labs, we are focusing on H.R. 5158, which I want to get into. I just wanted to point out that 30 percent of that is from there, and we have not heard anything from individuals protesting what is going to happen in terms of that loss of contribution.

Dr. PENZIAS. Well, we protested in court for a couple of years, but in fact, in order to get out of court, we had to give something up. It certainly was not my idea.

Mr. WIRTH. All right.

Mr. KEEFAUVER. Congressman Wirth, if I could clarify that 30 percent, the 30-percent number is correct, but that funds some work which, after the modified final judgment, would not be done by Bell Laboratories, necessarily, so it is not a net loss of 30 percent.

Mr. WIRTH. I am only using your number, Mr. Keefauver, whatever number it may be.

Mr. KEEFAUVER. OK, sure.

Mr. WIRTH. Are you anticipating now that, under the settlement, Yellow Pages is transferred to the parent company, isn't that correct?

Dr. PENZIAS. That is my understanding.

Mr. WIRTH. There is about $3.2 billion worth of revenues that accrue to the local operating companies that under the settlement agreed to by A.T. & T. and the Justice Department, will go to the parent. Now, are you anticipating that that will fund Bell Labs?

Dr. PENZIAS. I am not a lawyer, but let me say one thing. The revenues from Yellow Pages are some amount of money, and I just take your word for whatever the money is.

Mr. WIRTH. $3.2 billion.

Dr. PENZIAS. $3.2 billion.

Mr. WIRTH. Which currently goes to the local operating companies, which now can go to the parent.

Dr. PENZIAS. Well, I am getting a little over my head because I am not a lawyer, but let me answer the question. When the ability to publish Yellow Pages goes to A.T. & T., the revenue does not necessarily also flow to A.T. & T. because the Bell operating companies have the address list and are free to charge for that address list and keep whatever appropriate amount of money ought to get to them because they have this unique facility. So it is not the $3 billion that flows with the Yellow Pages. There is some piece of it. Now, how much that will be subject to later negotiation, but if I had the address list and somebody else was going to make $3 billion from it, I am not going to give it away just for the price of xeroxing it.

Mr. WIRTH. Well, I mean that is what the settlement does.

Dr. PENZIAS. I don't think so.

Mr. WIRTH. It would give it away from the local operating companies to the parent, and you've got $3.2 billion——

Dr. PENZIAS. No. I am not sure, but again, I am not a lawyer, sir, so I shouldn't really comment.

Mr. WIRTH. I am not a lawyer either, but just watching what goes on, we have this enormous transfer of income going from the local operating companies to the parent now, and a lot of us have been arguing the Yellow Pages ought to stay with the local operating company. You don't call long distance to get a plumber. It is predominantly a function of the local companies that we think ought to stay there. But I don't want to debate that because that is not your issue.

Dr. PENZIAS. I only said that because my understanding is that is Mr. Baxter's feeling, that that is an unregulated enterprise and they ought to go on one side of some wall, but that is somebody else's social theories that I cannot respond to.

Mr. WIRTH. Well, the purpose of the question was to see if it had been told to you by the parent that Yellow Pages revenues would be going to Bell Labs, and you have not had any indication of that.

Dr. PENZIAS. No. The amounts of money that I am talking about are rather modest. It is really the principle that I am worried about. My funding comes almost two decimal places lower than $3 billion.

Mr. WIRTH. The reason I was asking that question, I am just still searching for a rationale for transferring Yellow Pages from the local operating companies to the parent, and I thought we might have had one.

Dr. PENZIAS. No, the rationale is not, to my knowledge, directly related to research.

Mr. WIRTH. I mean, that is helpful, and I thought that might have been one of the rationales. Mr. Keefauver?

Dr. PENZIAS. There is nothing about Yellow Pages in my testimony at all, sir.

Mr. KEEFAUVER. I believe the rationale has been addressed by Mr. Baxter, assistant attorney general, whose theory was followed in the consent decree of dividing the business between what was considered competitive and what was considered noncompetitive. That was the rationale. It had nothing to do with the funding of Bell Laboratories.

Mr. WIRTH. All right.

Again, there is a separate total public policy issue as to whether Yellow Pages is a local concern or ought to move from Denver, Colo., or Wichita, Kans., to New Jersey.

Mr. KEEFAUVER. Sure, I understand.

Mr. WIRTH. And a lot of us think that it should stay with the local company, and I thought there might be a rationale there which related to you all on the funding for Bell Laboratories.

Sir, do you agree with the consistent policy of A.T. & T., which has been a consistent one, that what we ought to be doing is deregulating parts of AT&T that are competitive, like Western Electric, to compete in the marketplace with IBM or Hewlett-Packard or whatever?

Dr. PENZIAS. Let me understand. Do I agree with the idea that Western Electric should be free to follow its technology; that is, be

removed from the restraints of the 1956 consent decree, essentially?

Mr. WIRTH. Should be unregulated and be able to compete in the marketplace with other companies.

Dr. PENZIAS. Under some circumstances, I think that is a very good idea, sir.

Mr. WIRTH. I mean, that has been the policy. I think that is how we got into a lot of this to begin with, 5 years ago. You know, what was the difference between a telephone and a computer, and you can't really make that distinction any more.

Dr. PENZIAS. That was computer inquiry II; the idea being that we ought to be free to follow the technology, that the difference between telecommunications and data processing continues to blur as we move into the information age. That is quite true. It makes it very hard to do research whose consequences you, at some point, are not allowed to follow up. So it certainly makes it more comfortable for me if we are able to follow research wherever it leads.

Mr. WIRTH. And again, what we want to do is to have a competitive environment so that A.T. & T. is competing out there, unrequlated, without the constraints of the 1956 consent decree, and that is one of the basic policy threads that was agreed to by A.T. & T. and by the House and by the Senate. That that is the goal that we are all after.

Dr. PENZIAS. That is correct, sir.

Mr. WIRTH. Assuming that that is the case, then we want to make sure we have a fair competitive playing field, and therefore we don't want to have subsidies flowing to A.T. & T. competitive offerings from A.T. & T.'s regulated offerings, and that has been a consistent, I think, public policy agreement over the last 5 years. Isn't that right?

Dr. PENZIAS. The concept of a fair or flat playing field gives me a lot of trouble. Western Electric has an advantage, very honestly, because it is connected to Bell Laboratories, which other companies in the United States do not fully share.

Now, if you want to make the United States into a flat, fairly equally competitive playing field, taking away that advantage, you move everyone in the United States down to some lower level. You can move them down there, but you are not doing anything to Japan, Inc.

So there are certain advantages that Western Electric has which in some case compensate for things like the cheap labor in Japan or the Government loans or what have you. But I certainly agree with you, sir. and I said it in my testimony, that I feel that there should not be any net flow, any net benefit, to either Long Lines or the unregulated portion of A.T. & T. that they are not paying for in fair proportion.

Both sides, however, benefit more from the result than they are paying for. They both make a profit. If two people exchange something, both people are better off.

Now, what I mentioned earlier has to do with the solid state amplifiers which are now being developed in research, which are now being produced in research, for the benefit of Long Lines, which draw a great deal on Western Electric technology. Now, that is an advantage which flows to Long Lines because of this synergism.

Similarly, there are benefits which flow to Western Electric, and both parts are better off, and I fully agree that someone should continue to have a watchdog authority to make sure that the fraction of our research that is appropriate, that ought to paid for by Long Lines, or the regulated part, is paid for by that regulated part, no more and no less. That is what the FCC and the State rate commissions have done in the past, and I see no reason and I have no objection to their doing it in the future.

It is merely the piecemeal business in the wording that I read in this bill that gives me a great deal of trouble. That is, I think, where we disagree.

Mr. WIRTH. All right, then, in a policy direction, from what you just said in that last paragraph, we have absolutely no disagree ment whatsoever.

Dr. PENZIAS. It is only in the implementation, I think.

Mr. WIRTH. There is basic long-term research that can be funded and should be funded by Long Lines for Bell Labs.

Dr. PENZIAS. But jointly funded is the problem.

Mr. WIRTH. The remaining question would then appear to be only your interpretation of what section 251(c)(5) says. Is that correct?

Dr. PENZIAS. And the interpretation of whoever is going to give me the money or not give me the money, correct, yes.

Mr. WIRTH. OK, so we agree.

Dr. PENZIAS. On the principle.

Mr. WIRTH. The subcommittee certainly intends in every way that Long Lines be able to fund research at Bell Labs but, as under current practices, if that is coming out of regulated revenues, that must be accounted for. Correct?

Dr. PENZIAS. Well——

Mr. WIRTH. As we do under current practices. I mean, there is no difference on that, right, except——

Dr. PENZIAS. Well, I think there is a very great difference between the way it is currently done and the language in the bill as I read the bill. That is, I think, where the problem is.

Mr. WIRTH. That gets down to the question of how we read the language.

Dr. PENZIAS. Yes, sir.

Mr. WIRTH. Now, for the purposes of the record and the Committee on Science and Technology, we should point out that in the process of drafting H.R. 5158, we have been in discussion with absolutely everybody who was concerned about the legislation. I mean, I am thoroughly anesthetized by the openness of the process in which everybody has been involved, with one exception. Until 3 weeks ago, we were absolutely stonewalled by A.T. & T. since November, who refused to participate in any way, shape, or form, whereas everybody else—GTE, ITT, and the rurals, and the State PUC's, and everybody else and their cousin was in saying, we've got this interpretational language, or what do you really mean by that? I mean, we have eight people on this subcommittee. A.T. & T. has 8,000 lawyers or whatever it is. We would like to have the help of A.T. & T.

Consequently, we had a very lengthy discussion with the board of A.T. & T. 3 weeks ago.

Dr. PENZIAS. I understand that, sir.

Mr. WIRTH. Congressman Swift and Congressman Tauke and I went up to A.T. & T. and said, you know, you all may want to stonewall this bill and may want to kill the bill, but the bill is moving, and it seems to me you have the responsibility to come in and discuss with us what problems you have. We may have substantive disagreements, but on the situation as in 251(c)(5), you know, there is simply an interpretive discussion, and let's have the benefit of your input as we have asked for and gotten the help of everybody else.

Now, finally, we have had some kind of a breakthrough there, and I greatly appreciate that, that A.T. & T. has, for the first time, been willing to come in, not just to sit on the outside and hurl brickbats at H.R. 5158, but to come in as a constructive partner in attempting to get the legislation written in a way that is absolutely clear so there is no misinterpretation, which is currently what is going on in relation to 251(c)(5), and I appreciate that. I am glad that we have finally gotten to that point so that instead of having this horrendous attack made on a piece of legislation as if somehow we are bent upon the destruction of Bell Labs and bent upon the advocacy of Japan, Inc., we are in a situation where the intent of the subcommittee, which everybody else understood, is now being understood by your lawyers.

That is where we are at this particular point. We are in the process, and A.T. & T. has raised some issues about how that language could be read, and I think that is very constructive and that is very productive. I am glad that that is finally happening, and I think that coming out of this now as we look at that language and move into full committee markup next week, we will be able to clarify to the satisfaction of A.T. & T. what the intent was so that there can continue to be basic long-term research funded by Long Lines and funded by Western Electric at Bell Labs accounted for on a pro rata basis and in the fashion where you don't have the cross-subsidies going from regulated revenues to the competitive side, which is again the policy goal that we all have. So we are getting there, Dr. Penzias.

Dr. PENZIAS. I followed you, sir, almost until the very last phrase that you came up with. I think we do have to continue to talk about that, which is the question of the pro rata basis. It is fine, but we have to make sure that it does not mean the detailed tracking of each item, and that is a very specific difference.

Mr. WIRTH. We understand that, and that is what we are working on at this point.

Dr. PENZIAS. Fine. If we somehow can get rid of these concerns, I certainly will be very much happier.

Mr. WIRTH. Well, we are, and I must say it is very frustrating to try to write a piece of legislation when you have this enormous operation beating up on the legislation and trying to kill the legislation and not being very constructive. I think we have made a significant step in the last 3 weeks of finally getting A.T. & T. to recognize that legislation is going to pass in this Congress, and it does accept almost everything that is in the consent decree with the exception of Yellow Pages and the exception of terminal equipment, which we think ought to stay in the local operating companies.

We have no disagreement, I think, with everything that you have said about what ought to be done at Bell Labs and what the subcommittee intended in drafting H.R. 5158 with respect to Bell Labs and having some questions of interpretive language. Those are currently being cleaned up, and there are some very lengthy and healthy discussions going on now between the subcommittee staff, majority and minority, and A.T. & T.'s counsel. I think those are proceeding very well with particular reference to the subject of today, which is 251(c)(5).

So that is all I have got to say. I think that we are agreed upon the basic goals, and if there is anything that you might like to add—we are agreed upon the basic goals; we are agreed upon the basic cross-subsidy issue; we are agreed that there ought to be funding that goes in situations from Long Lines to Bell Labs—it is a matter now of making sure that the language implements all of that. We are in the process of working on that.

Dr. PENZIAS. I think that certainly that is one issue, and I am glad to see that we are much closer on the funding than the language of this bill, at least my reading of it, indicates.

But another place in here where I have a problem which is in some ways just as serious has to do with information flows, and that is in section 252(a). There is one sentence in there which really scares me. It has the word "any" in it three times. "Any material change in any technical requirement which shall be required by the specific design or development of any telecommunications facility, service, or product."

That section, as I read it, would prevent, because that particular section is referred to later at a place where it says: "No carrier subsidiary may disclose to or receive from any other affiliate of the dominant carrier." In other words, you cannot get information, you cannot get it back, until such information has been made available to the public. It means I cannot discuss any technical issue with my supporters, or they with me, which in some way could ultimately lead to the design or development of a telecommunications facility or product.

The kinds of discussions which ultimately lead to ideas are then ultimately reflected in other ideas which move back. The information flow two ways is really the only product that is involved.

If my information, as it goes back to the people who have paid for my research, must first be made public—in other words, everybody has to get it at that instant, as I understand it from this bill—then again we have got information flow barriers which are as serious an impediment as the funding question may well be.

That is how I read it, but again, as I say, I am not a lawyer.

Mr. WIRTH. Again, that is certainly not the intent of the subcommittee nor anyone else's interpretation of what that language means, other than A.T. & T. If that causes a problem, that is not the intent of what the subcommittee says.

Dr. PENZIAS. Well, that is very nice to hear.

Mr. WIRTH. That is what we have said to your lawyers in the last 2½ weeks. On the first point, and as A.T. & T. has said to us and acknowledges, the purpose is to make sure that anybody using the network is not in a position to do any kind of technical harm to the

network, which is the purpose of the provision that you were talking about earlier.

A.T. & T. understands that that is the intent of the legislation, and again, if there is a problem on the interpretation of precisely how the language says that, we are very glad to have A.T. & T.'s input—let me say again—after 6 months of deafening silence. That is very helpful.

Dr. PENZIAS. Well, not totally deafening. I do know that many of my colleagues have written letters to you on some of these issues.

Mr. WIRTH. We have gotten all the form letters.

Dr. PENZIAS. I am much happier to talk about the future than the past, and if we can move ahead in this way, I am certainly very happy. I am a scientist, and I would love to go back to just doing science.

Mr. WIRTH. Exactly, and I am a working politician who would love to get beyond this issue and get H.R. 5158 behind us so we can go focus on some of the other issues the country ought to be working on. With A.T. & T.'s help, we can certainly expedite the whole process, and you can go back to science and I can go back with my colleagues to doing other than answering letters from stockholders, retirees, and employees. That would be helpful. [Laughter.]

Dr. PENZIAS. And others who are concerned about science.

Mr. KEEFAUVER. Congressman Wirth, if I could just amplify for a minute, as one of the somewhat less than 8,000 lawyers in the Bell System, our concern with information flows is quite simply stated. We understand and respect the need for promptly disclosing new protocols, new technical requirements for interconnection. Indeed, that is our present practice and has been for some time.

But we get very sensitive when we see prohibitions on exchanging information prior to some vaguely defined point in time, because it is these interactions prior to that time which help make these protocols useful and realizable. If these systems requirements or protocols have to be designed in a vacuum, as they indeed are in some other telephone companies abroad, they are very likely to be wrong the first several times. But if you can permit these interactions prior to that time with users, not just your own but others, provided you promptly disclose them, then we have no difficulty.

But the way that section is now written, and because of some of the rather broad language in it, it would seem to create a wall between those who would design protocols and technical requirements and those who would have knowledge of the real need for them in the field or the research or technology available to help define them. But I am heartened by your remarks that this is perhaps a minor semantic difference which can be clarified by wording changes.

Mr. WIRTH. Thank you, Mr. Chairman.

Mr. FUQUA. Thank you.

Mr. Gregg?

Mr. GREGG. Thank you, Mr. Chairman.

To follow up on that line of reasoning, it appears to me just reading this that it is more than semantics here. The tenor of the bill seems to me to be one that is going to have a chilling effect on the collegian atmosphere that is necessary for the movement of science, for the movement of technology within any fun tion of the

Bell Laboratories or Western Electric as a combined entity. Is that incorrect?

Dr. PENZIAS. Well, that is what I have said. I agree with that. At least that is my reading of the bill, and chilling effect is a very good description. Yes, sir. The present bill, of course, not what we hope for.

Mr. GREGG. That is correct.

Isn't one of the real problems we are having is maintaining our competitive advantage with the rest of the world markets, specifically Japan and West Germany, in this area?

Dr. PENZIAS. I think we have our hands full dealing with competition. I think that is true, sir.

Mr. GREGG. So shouldn't we really be dealing with our efforts in the area of research and technology as it relates to telecommunications, not so much regarding competition within the United States, although that is certainly important, but regarding the fact that we are a global economy and we are a world enterprise when it comes to telecommunications?

Dr. PENZIAS. I think that is quite true. There is a world-sized contest out there, and I think Western Electric has been doing pretty well in that market, in that competitive world.

Mr. GREGG. And doesn't this bill really take a terribly narrow view that there is no world out there that we are competing with, that basically what we are competing with is the American companies that may have to confront the giant, Bell Labs and Western Electric?

Dr. PENZIAS. Well, I can only speak to the bill. I think Congressman Wirth has indicated there are some hopes for changing this, but as he speaks of the fair playing field, what we are talking about is reducing, presumably, all American competitors to the lowest common denominator. Under those circumstances, we then are all well below our foreign competitors, as you pointed out.

Mr. GREGG. Well, basically, we are talking about chopping off one of the feet of an American company so it will walk at an angle along with the rest of the American companies, while the world companies walk straight, right?

Dr. PENZIAS. Well, that sounds pretty awful, but it is something like that.

Mr. GREGG. It seems to me that if the United States is going to maintain a competitive edge in the world markets, it is going to be in high technology. It is not going to be in hard goods. We have sort of transitioned out of the hard goods phase of world economy. We are no longer as competitive as we used to be in hard goods, but we remain the leader in technology.

Shouldn't we as a committee be addressing ourselves to how we are going to keep that edge, how we are going to stay ahead of the rest of the world in technology?

Dr. PENZIAS. I certainly agree with that. I think, of course, that the information age kinds of technology that we talk about will help, also, with our ability to compete in hard goods areas as well. We can automate our factories; we can give the American working men additional, more sophisticated tools if in fact the benefits of computers, modern integrated circuit technology, information han-

dling techniques are made available in the workplace as they are in others.

And so I see that the broadest possible range of American competitiveness can be benefited from by high technology appropriately applied.

Mr. GREGG. And, to get back to my initial point, this bill is going to have a chilling effect on the ability to produce that technology to compete in the world community.

Dr. PENZIAS. This bill worries me a great deal as it is written, and it certainly has that chilling effect at the present time, yes, sir.

Mr. GREGG. Would you happen to have proposals which you think would improve the language of the bill so that it would not have that sort of impact on the telecommunications industry?

Dr. PENZIAS. Personally, I am not a lawyer, and I am sure that if I were to write something down, it would probably be worse. The writing of unambiguous language is a very tough job, so, personally, I cannot do that, but I am sure that, as Mr. Wirth has pointed out, such proposals will presumably be forthcoming from somebody.

Mr. GLICKMAN. Would the gentleman yield on that point?

Mr. GREGG. Certainly.

Mr. GLICKMAN. I am curious because the gentlemen, Dr. Penzias and Mr. Wirth, talked about the fact that there are ongoing negotiations right now with attorneys from the Bell System. Have you or Mr. Ross at Bell Labs been involved in the sections of the bill relating to the research?

Mr. KEEFAUVER. We have not been actively involved until very recently, but we will certainly be cooperating with the A.T. & T. folk who are in discussions with the people on Congressman Wirth's staff and committee and subcommittee.

Mr. GLICKMAN. I have some sympathy with what the gentleman from New Hampshire is saying, but as I understand it, there is now apparently a good-faith effort going on between the Bell System and members of other authorizing committees to try to work out some of the problems that Dr. Penzias mentioned today, and I would just hope that the relevant persons within the Bell System are able to participate in those conversations.

Mr. KEEFAUVER. We will certainly do that. Until now, we have not had specific fixes for specific sections of the bill because, as Congressman Wirth himself observed, you cannot read isolated sections of this bill and understand it. One has to read the entire framework, and it was the entire framework, which gave A.T. & T. considerable difficulty, and a patch here and a patch there would not really fix what we perceive to be the underlying difficulties with the overall framework.

But if there is an open mind as to what the framework should be, and I understand there are now open discussions on that, then once we establish that framework, certainly it would be no great chore to propose specific language to deal with these issues which we are discussing here this morning, namely the funding of research, the important information flow questions, and we would be pleased to do that.

Mr. GREGG. Fine. Well, I will look forward to obtaining that language.

Mr. KEEFAUVER. But I would compliment Congressman Gregg for observing correctly that it is an international marketplace we are dealing with, and it is international competitive not just for Western Electric, not just for the Bell System, but for the U.S. economy as a whole that should be considered by this and other committees, as I am sure it is.

Mr. WIRTH. Would the gentleman yield?

Mr. GREGG. I will yield to you or I will yield back my time and have the chairman yield.

Mr. WIRTH. I thank you. I would just like to point out that as we talk about the international economy, which has been one topic of a number of hearings by this subcommittee and by the subcommittee that I chair, it has been very clear that the United States is in a much better position to compete with more competitors here at home. The more competitive entrants you have in the United States, the more likely it is you are going to penetrate international markets. That argument was very clearly and forcefully outlined by Mr. Brock, the U.S. Special Trade Representative who, along with members of the Subcommittee on Communications, wants to encourage as many competitive entrants as possible.

I should just point out for the record that that is again one of the themes and goals of H.R. 5158 with which I believe most people agree. The more competitive entrants we have in the United States, the more likely it is that we are going to be effective in the world market. That includes A.T. & T., which has only recently decided to enter that world marketplace. A.T. & T. had historically been only a domestic company, had refused or decided not to go into international marketplaces, and ATTI, ATT International, was just recently established and set up to enter those international marketplaces.

So we should understand that we are trying to encourage not only A.T. & T. but a whole lot of other people to enter that international marketplace.

Dr. PENZIAS. May I make a comment, sir?

Mr. GREGG. Go ahead.

Dr. PENZIAS. I just want to say that the number is one thing but quality is another as well; that is, just to increase the number of weaker players on your side does not necessarily increase the strength of your team, and to take the simplest example, if one fragments A.T. & T. or Western Electric into separate pieces, each of those separate pieces increases the number of American competitors but does not do the same thing to America's competitive edge as one coherent player on the world stage.

So I don't think I disagree with what you are saying, and I am sure you did not mean in your statement anything about weakening one of those players, but I think we do have to point out that it is not just the number but the strength and health of those competitive American enterprises which is important, and I just wanted to add that. It in no way contradicts what you have said, of course.

Mr. WIRTH. There is no intent in the legislation to fragment, nor is there any language that fragments Bell Labs, unlike the Senate bill, supported by A.T. & T., which did split Bell Labs. I just want to point that out.

Second, I think there are a number of electronics companies in the country that have had a very distinguished record of penetrating foreign markets. As the record will show, A.T. & T. has not been in that international marketplace. You know, Motorola, for example, is currently marketing a good deal of equipment in Japan.

Dr. PENZIAS. I think that that is a very true statement. I couldn't agree with that more, that our American companies have done quite well in the market. I can, however, quote the London Economist in a recent editorial which concluded with the words, "Silicon Valley depends on Bell Labs." Our publication policy, our flow of ideas contribute at the present time to the competitive edge that many American companies have, and I want to continue that by having the same kind of healthy, broad-ranging, open-publishing kind of research effort that we have now.

Mr. WIRTH. And so do we.

Dr. PENZIAS. I am very glad to hear that.

Mr. WIRTH. I don't think there is, again, any disagreement on that, Dr. Penzias.

Dr. PENZIAS. Thank you.

Mr. WIRTH. It is a matter of interpretive language, and we will get our respective "legal beagles" together and take them to the doghouse or whatever and put them in there and get them to agree on that language so that our mutual goals can be met.

Dr. PENZIAS. That is what they do best. I think that is very nice.

Mr. GREGG. And I will be happy to yield back my time. [Laughter.]

Mr. FUQUA. The time of the gentleman has expired.

Dr. Penzias, thank you very much for being here today.

Dr. PENZIAS. Thank you very much.

Mr. FUQUA. And also you, Mr. Keefauver. Thank you for being here.

Mr. KEEFAUVER. Thank you, Mr. Chairman.

Mr. FUQUA. We appreciate it very much.

Before we continue, we have another vote, and we will take a short recess. Jack, we will be right back and hear from you.

[Recess taken.]

Mr. FUQUA. The committee will be in order.

Our next witness will be Dr. John H. Gibbons, the Director of the Office of Technology Assessment of the Congress of the United States.

Jack, we are happy to welcome you back again and would be pleased to receive your testimony.

STATEMENT OF JOHN H. GIBBONS, DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT, ACCOMPANIED BY DONNA L. VALTRI, ECONOMIST, COMMUNICATIONS AND INFORMATION TECHNOLOGY PROGRAM, OTA

Dr. GIBBONS. Thank you, Mr. Chairman.

I have with me this morning Ms. Donna Valtri, who is an analyst on the OTA staff and participated in the preparation of this testimony.

Mr. FUQUA. Thank you.

Ms. VALTRI. Good morning.

Dr. GIBBONS. Mr. Chairman, OTA does not have a study specifically focused on the Bell Laboratories issues, but my remarks are drawn from some associated work presently going on at OTA or recently completed here and are also flavored by my personal past experiences in both administering and carrying out research in universities and national laboratories.

I will submit my full statement for the record and provide a set of summary comments to you, if that is appropriate.

I don't think anyone disagrees that communications is important to the overall economic growth and security in the United States and will be increasingly so in the coming years. The basic structure of the industry is changing due to two primary factors. One is the process of deregulation, including the consent decree and proposed legislative efforts such as H.R. 5158.

The second major factor that we have to keep track of is the impact of the technological innovation that is occurring not only here in the United States but around the world, and this is happening in two streams. One is the merging of communications technology with computers, and the second is that many other technologies themselves are now presenting new opportunities: fiber optics, satellite technology, and the like.

The key issue, it seems to me, for U.S. science and technology policy is what effect will these changes have on the overall U.S. research and development picture in the communications and computer technology area. Bell Labs has been a major contributor to R. & D. underlying this whole industry in the United States. It is, therefore, most appropriate to be concerned about the role that Bell Labs will play in the new industrial and technological environment of the future. As Dr. Penzias quoted a few minutes ago, Silicon Valley also depends on Bell Laboratories.

The Bell Laboratories 1982 budget of about $2 billion is one of the largest laboratory budgets in the United States. The so-called basic research or research component of that budget is perhaps 10 percent of it or about $200 million.

But perhaps more important at this point than dollars spent is the way in which Bell Labs is organized and managed and how that process might be influenced by the legislation under consideration. The labs are not funded by contract. Most of the funds are rather unfettered. The lab management itself decides on its research agenda, research priorities, and research projects.

This allows the labs flexibility in their choice of projects and concentration, therefore, on all aspects of innovation. It allows the performance of basic research in an environment that is intimately associated with the marketplace of users. This is not a model of technological innovation that is often duplicated here in the United States.

There are also public utility characteristics of this firm such as A.T. & T.'s obligations to society for, in turn, having the privilege of operating a monopoly, and this public utility characteristic encourages Bell Labs and sustains their position of performing research in an open environment.

Some of these characteristics may well change in the face of the consent decree and of proposed legislation: the loss of contract li-

cense fees from the Bell operating companies, perhaps $600 million flowing to Bell Labs from that source in 1981 will be one result of the consent decree.

Now, these contract fees are used for both software design—that is, their business information systems program—and for the research and systems engineering program of which basic research is a part.

The issue is, if there is a loss of these contract fees, how might they be replenished? Well, one source, obviously, may be the parent company, A.T. & T. itself, Western Electric, and the Bell operating companies via specific contracts are other possibilities.

A.T. & T.'s ability to fund Bell Labs as they have indicated they would, might increase due to new revenues from their new information services that come out of the deregulated environment, but will the allocation of funds among the Bell Labs' various activities change? That is an issue on which I do not think anyone has a very clear picture.

So there is an issue of the future allocation of funds that would be available or flow to the laboratories.

Now, we might see more product-oriented research due to the labs' being placed in essentially a more competitive environment, but that might also be at the cost of some basic research. Even if the funds are replenished for the same projects, such funding may still affect technological innovation through the loss of this integration process that links research to the marketplace in the Bell System and/or it may affect management flexibility, due to the fact that they would have much more constrained use of the funds available to them.

Well, what if basic research at Bell Labs is diminished? There are obvious impacts for Federal science policy. Of some $6 billion Federal spent on basic research, and that includes DOD, probably less than 15 percent of that flows to telecommunications. That 15 percent of the $6 billion includes all of the math, computer sciences, and engineering programs of which telecommunication is a small part.

Therefore, the loss of the Bell contribution to basic research in telecommunications could raise pressure on the Federal Government to make up the difference, as basic research is certainly critical to long-term U.S. competitive position in world markets.

Another issue is the access to patents and technical information that has traditionally flowed from Bell Labs. Many non-Bell entities, both foreign and domestic firms, have had access, easy access, to over 20,000 patents and about 2,000 technical papers per year. Patents are licensed through the 1956 consent decree, and that would presumably cease and could increase the burden on Federal providers of such resources.

There is another concern within the issue of the loss of licensing requirements. A.T. &. T. could possibly feel more free to make some strategic—that is, market—use of patents under the pressure of competition.

We also heard earlier this morning, some discussion about the question of technical publications. Bell Labs' freedom to publish has attracted absolutely topnotch professional people to that organization, and this has had a positive influence on the quality of

personnel and innovativeness, we believe, throughout the entire Bell system. Increased competitive pressures could prejudice some of that activity, and it could therefore put more pressure on the Federal Government to fill the gap left by a diminished publishing inclination on the part of Bell Labs.

A final issue I would raise, Mr. Chairman, is the impact on the U.S. competitive position. In the short term, a more finely tuned and market oriented Bell Laboratories might be the driver or provider of products and services in industry in a spurt of activities; that is conceivable.

The longer term situation, however, is much less clear. Diminished basic research—that is, research that is not directly connected to a product or to a service but is relevant to telecommunications—that kind of work at Bell Labs, if it were diminished, could be a long-term handicap on all of U.S. industry, and this presents again pressure on the Federal Government to provide that lost portion of basic research in an era of budget cutting.

So, in summary, Mr. Chairman, it appears that Bell Labs performs a major portion of telecommunications basic research for the whole United States. This has been made possible by a system of funding and a management decision process that is now in question.

The activities supported by those funds have also been conducted in an environment that has been judiciously linked to the marketplace, yet sufficiently unfettered so as to have produced an enduring quality and productivity of the organization. Even if the Federal Government is able to make up for any decrease of basic research in telecommunications in the future, a Federal structure for basic telecommunications activities might not be able to provide the budgetary freedom and the marketplace-linked environment that has been the case at Bell Labs.

Mr. Chairman, that completes my summary of my testimony. We would be pleased to try to respond to any questions.

[The prepared statement of Dr. Gibbons follows:]

TESTIMONY OF JOHN H. GIBBONS

DIRECTOR, OFFICE OF TECHNOLOGY ASSESSMENT

BEFORE THE COMMITTEE ON SCIENCE AND TECHNOLOGY

U. S. HOUSE OF REPRESENTATIVES

JUNE 9, 1982

The Future of Bell Telephone Laboratories

I am pleased to be here this morning to discuss the future of Bell Labs with you. I will be speaking on this important subject partly from my own background. I will also be drawing from the expertise of staff members at OTA as well as information gathered in the course of recent and past studies in telecommunications, national information systems, microelectronics, the patent system and the national laboratories system.

It is clear that telecommunications and information technology are cornerstones of the U.S. high technology effort. They form the vital network of communication and information services that support the domestic economy. They are also a major factor in U.S. industrial competitiveness abroad and promise to play an even larger role in the future. As well, they are an indispensible component of our national security systems.

Now, driven both by trends toward deregulation and by a rapaidly advancing technology, the basic structure of the communications and computer industry is changing. H.R. 5158 is only one manifestation of this change; the scope of which is much more profound.

Communication products and services are merging, and the roles of the major firms in the field are shifting. Old boundaries will disappear as computer firms begin to offer specialized communication services and as traditionally regulated communication firms begin to enter the information services business. Finally, the technology itself, driven by developments in such fields as microelectronics, fiber optics, satellite technology, and computer software, is undergoing significant and rapid change.

For many years, Bell Laboratories has been a major contributor to the national research and development effort underlying the development of telecommunications and computer technology in this country. It is, therefore, important to ask what role Bell Labs may play in the different industrial and technological landscape that will exist later in this decade. For, it is not surprising to suggest that as the regulatory and financial environment changes, the responsibilities and operating style of Bell Labs will similarly change.

The key issue for U.S. science and technology policy, then, is what effect these changes will have on the overall U.S. R&D picture in communications and computer technology.

Bell Labs' 1982 budget of 2 billion dollars makes it one of the largest private R&D commitments in the country. Its "basic research" function, defined as the pursuit of fundamental knowledge not related to products or services, represents about 10 percent of that or about 200 million dollars. More important perhaps than the number of dollars spent is the way in which Bell Labs is organized and managed. Bell Labs is the largest of a few select private

research institutions whose basic research is not funded on a contract basis; that is funds are not given to the institution by outside sources or from divisions of the firm for specified purposes. Rather Bell Labs executives involved in basic research are able to choose which projects they will undertake without the market influence of AT&T or Western Electric that accompanies Bell Labs' choices of projects in areas of product development. Several other private laboratories like GE, RCA and CBS Labs have this flexibility in their allocations to basic research, but on a much smaller scale.

This flexibility in its basic research resource allocation and Bell Labs' role in all of its resource decisions has allowed Bell Labs to become involved in all facets of telecommunications innovation; basic and applied research, demonstration and market introduction are all integrated. This concentration on all aspects of innovation, and particularly the performance of basic research in an environment intimately associated with the marketplace of users is not a model of technological innovation often duplicated elsewhere in industry. These diverse areas of the innovation process are connected through the close and continued interactions among Bell Labs, AT&T and Western Electric. These connected links are quite likely to be much more efficient as a whole than would be their separated parts.

The historic public utility characteristics of the Bell System have encouraged Bell Labs to be open in its activities such as in reporting its research results. This coupled with the patent licensing provisions of the 1956 Department of Justice Consent Decree has created a situation in which many other companies, and industries, have commercially benefited from Bell Labs' research.

In the future some of the integrated nature of the innovation process at Bell Labs, its resource allocation flexibility and its openness may change. One of the major motivations for some of these changes appears to be the loss of funding through the system of license contract fees. Currently, the Bell Operating Companies (BOCs) pay to AT&T a yearly sum equal to approximately 2.5 percent of their gross operating revenues. For these fees, the BOCs are entitled to several services from AT&T including the benefits of Bell Labs' research. Our rough estimate indicates that for 1981, the BOCs' contribution to Bell Labs amounted to about 600 million dollars.

The BOC license contract fees pay primarily for two areas of activity at Bell Labs. First, the fees support the Business Information Systems Programs; the software design activities. These activities represented about 11 percent of Bell Labs' effort in 1981. Second, the BOCs fund about 80 percent of the Research and Systems Engineering functions. The other 20 percent of these funds is provided by AT&T Long Lines. These activities represented about a third of Bell Labs' total budget in 1981 and include the basic research function. The remainder of Bell Labs' funding is provided by Western Electric (about 54 percent in 1981) and is directed toward Specific Development and Design. Another 3 percent is paid for by Western Electric for National Defense and other government contracts and these monies are reimbursed by the federal government.

Under almost any competitive configuration (H.R. 5158, the Consent Decree, some combination or wholly new scheme), the license contract fees from the BOCs will cease. The BOCs will likely be able to individually contract with Bell Labs for specific research projects, but Bell Labs' major source of

discretionary funds as we now know ~~them~~ it will no longer be available. This loss of funding raises the simple question of whether these funds will be replaced and how. Perhaps AT&T, Western Electric and individual BOC contracts will replenish the lost funds. As AT&T enters new areas of communications, its revenues may increase and its ability to fund Bell Labs may be similarly enhanced. But this potential source of replacement funding for Bell Labs raises a different concern: the future allocation of resources at Bell Labs. Of particular concern is the funding of basic research.

By definition basic research is not directly related to products or services. Certainly, a firm's long-term competitiveness is dependent, in part, on a basic research effort. Many major industrial concerns in the U.S. have recognized this, IBM and Xerox among them, and have spent portions of their R&D efforts on a basic research function. However, the intensely competitive conditions under which IBM and Xerox have long operated would be a relatively new set of circumstances for AT&T and Bell Labs.

Following deregulation, many wholly new areas will be open to AT&T's participation. Under such circumstances, it is not unreasonable to expect that Bell Labs, in support of AT&T's entrance into computer technology and information services will be encouraged to employ a more market-oriented research strategy; at least in the short term. Software development and customer equipment design seem likely choices for increased activity. Both areas are experiencing keen foreign as well as domestic competition. Such a change in emphasis may be accomplished at the cost of some of Bell Labs' basic research function.

There is also the possibility that even if Bell Labs' funding is replenished in full and devoted to the same efforts as in the past, the resulting impact on telecommunications innovation could still be significant. We do not know how much of Bell Labs' past productivity is reflective of the integration of all of the aspects of the innovation process in the Bell System; that is, will the divestiture of the BOCs be important to the integrated nature of research at Bell Labs? Further, we do not know to what extent Bell Labs' record was made possible through the management/budget decision process which exists, in part, as a result the infusion of untied funds. Will funds presented in a contracted form diminish the capability of Bell Labs to capitalize upon some of the creativeness of its employees?

If the basic research effort at Bell Labs is diminished in the future, there will be some consequent impacts on federal science and technology policy which need consideration. The federal government is the largest contributor of funds for basic research in the U.S. The National Science Foundation's estimate for government funding of basic research in 1981 was about 6 billion dollars. Industry contributed approximately 1.5 billion and colleges, universities and other nonprofit institutions spent almost another 1.5 billion on basic research activities. The federal government's share is almost overwhelmingly directed toward life and physical sciences.

The federal government's obligations in mathematics, computer sciences, and engineering combined (areas in which pieces of telecommunications research can be found) amounted to about 15 percent of the total, or about 900 million dollars. Since these categories of federal funding also include monies for

aeronautical, astronautical, chemical, civil, mechanical, materials and other areas of basic research, it is reasonable to assume that federal support for communications research, per se, represents some small fraction of that 900 million dollars. Thus Bell Labs' contribution to total U.S. telecommunication basic research probably represents the better part of the total spent in this area. A loss in Bell Labs' funding of basic telecommunications research may increase the pressure for federal funding in this area as such a loss may raise concerns about the long-term competitive position of the U.S. Indeed, such a loss may have implications for world wide innovation in this industry. Much of Bell Labs' work in optical fibers, solid state electronics and lasers, for example, have been commercially exploited by foreign as well as domestic firms.

Another area of concern with regard to the future of Bell Labs is the potential loss of access to patents and other technical information for non-Bell entities. Currently the Bell System holds over 20,000 patents and publishes the Bell System Technical Journal, the Bell Labs Record and about 2,000 individual technical papers per year. Bell patents are available through licensing arrangements made under the 1956 Consent Decree with relatively low, and in some cases, nominal fees. These arrangements are likely to cease under any of the contemplated future structures for the Bell System. If Bell Labs continues to obtain patents at its historic rate of one per day since 1925, a change in the degree of access to these patents could have serious implications for the industry and federal science policy. The loss of this wealth of technical information could place an increased burden on federal providers of such resources.

A further complication may be found in the increasing incentives provided by a competitive market structure on Bell Labs to make more strategic use of its patents. These pressures, combined with Bell's market power (even under a divestiture arrangement) and its track record in obtaining patents may lead AT&T to "fence-in" technology areas in order to protect its market positions.

The proliferation of published technical journals and papers by Bell Labs has always been a strong point of attraction for top-notch personnel and, as such, may remain so in the future. Furthermore, the existence of a first-rate research group undoubtedly has a positive influence on the quality of personnel throughout the rest of the organization. However, one must again raise the question of the influence of competition on this relatively open publishing environment in the future. Again, a diminished publication effort by Bell Labs may increase the pressure on alternative federal publishing sources.

If the competitive environment of the future turns some or all of the concerns discussed above into reality we can expect certain changes in the U.S. competitive position in telecommunications. In the short term, a more market-oriented Bell Labs could greatly improve the U.S. position in this increasingly important competitive industry. The output of Bell Labs may be the driver in product and service developments in the industry. Our longer-term position may be less salubrious however. A diminished emphasis on basic research at Bell Labs could present a handicap to the future of the U.S. industry and in this regard presents implications for federal science policy.

It appears that Bell Labs performs a major portion of telecommunication basic research which has been made possible by a system of funding and a mangement decision process that may be in jeopardy in the future. The activities supported by those funds have also been conducted in an environment judiciously linked to the marketplace, yet sufficiently unfettered so as to have produced enduring quality and productivity.

Even if the federal government is able to make up for any diminution of basic research in telecommunications in the future, a federal structure for basic telecommunication activities may not be able to provide the budgetary freedom and marketplace-linked environment that has been the case at Bell Labs.

Mr. FUQUA. Thank you very much, Dr. Gibbons.

You mentioned just at the end, do you think that if the provisions of H.R. 5158 are enacted that there would be pressure on Bell Labs to try to secure more Federal funds for basic research? About 10 or 15 years ago they had a very high percentage of their funding from the Government. That has diminished in recent years, but do you think there would be pressure on them to try to seek an increased amount of Federal funding?

Dr. GIBBONS. Mr. Chairman, I am not sure of the extent of the influence of H.R. 5158 on that point because if the consent decree is finalized——

Mr. FUQUA. Either one, I meant.

Dr. GIBBONS. Either one would have the same effect of blocking the traditional flow of unfettered funds into the organization, and $200 million, even for a company the size of A.T. & T., is still a pretty good sized number. So I think there would be increased temptation to seek out sources from elsewhere.

Mr. FUQUA. Do you think there would be the inclination on the part of the management of the operating companies as well as the Long Lines Co., both of which would be regulated, to continue to see the value of basic research, particularly since they could pass it on to their customers, as has been the case in the past and as we have in other cases such as EPRI and GRI?

Dr. GIBBONS. Well, it depends. Of course, I think the basic operating companies would have to view this in terms of their own enlightened self-interest, and to some degree their interest in supporting generic research, research broadly related to their goals and missions would depend a lot on their market freedom in entering various lines of businesses.

Now, if the companies are constrained from entering the information services, terminal equipment, and other competitive activities, as I believe they are constrained under the consent decree, then they might be less interested in this broad-gaged research than if they did have that freedom to move in those new directions,

assisted by the new technology that could come out of the support of such work.

Mr. FUQUA. Well, do you think the revenues from A.T. & T., under the bill and the consent decree—A.T. & T. and their new competitive activities, and particularly from Western Electric—would not that be an incentive for them to try to continue to support basic research as in their long-range interest?

Dr. GIBBONS. I should think definitely so. In fact it would be interesting to look at the percent of revenues to the parent company, to A.T. & T., flowing into Bell Labs, the principal provider of new activities for the corporation, and compare that feedback into R. & D. with, say, other companies around the world, for example, in Nippon.

I think there will be an increased self-interest on the part of A.T. & T. to fund new product-related activities in the Bell Labs. I am not as convinced that the parent company would be equally persuaded to sustain the unfettered nature of basic research broadly relevant to telecommunications that has been going on in Bell Labs in the past.

Mr. FUQUA. You mentioned in your testimony that perhaps A.T. & T., Western Electric, and individual BOC contracts will replenish the lost funds.

Dr. GIBBONS. Yes, sir.

Mr. FUQUA. In particular, from their improved ability to compete as an unregulated company.

Mr. FUQUA. Thank you very much, Dr. Gibbons. We appreciate your taking your time to be here, and thank you for your testimony.

Dr. GIBBONS. Thank you, Mr. Chairman. It is a pleasure to be here.

Mr. Fuqua. Our next witness this morning will be Dr. Richard Damon, the past president of the Institute of Electrical & Electronic Engineers.

Thank you very much for being here, Dr. Damon. We would be pleased to hear from you at this time.

STATEMENT OF RICHARD W. DAMON, 1981 PRESIDENT, THE INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS

Dr. DAMON. Thank you, Mr. Chairman.

As you have stated, I am representing the Institute of Electrical & Electronics Engineers, the IEEE. I was the 1981 president of that organization.

This is a member society of approximately 160,000 electrical and electronics engineers in the United States and about 220,000 members worldwide. We have engineers from government, from industry, and from academia, and we are therefore deeply interested in the health and growth of the electrical and electronics industry in the United States.

We also have members who are concerned with communications and who are thus interested, in one side or the other, in the outcome of the matters pertaining to H.R. 5158, and particularly relating to the American Telephone & Telegraph Co.

However, we have a very diverse constituency. Some of our members regard the thrust of these proposals as a forerunner to the destruction or the degradation of the finest telephone and communications system on the Earth. Others regard these proposals as an avenue for promoting greater competition, improving efficiency, increasing innovation, and providing more opportunities for new businesses.

Because we have members with an interest on each side of the proposals, it is difficult for us to adopt a clear and unequivocal stance on the broad issues pertaining to the divestiture within A.T. & T. However, on the issue of preserving and sustaining a strong Bell Laboratories, our membership by and large is not divided. I think I am safe in saying that most of our members regard Bell Labs as an essential national resource whose health and vitality must be nurtured and preserved to continue further fundamental research, applied research, and engineering development.

The outstanding accomplishments of that laboratory have been instrumental in creating a system of communications which is the envy of the world, and indeed, some of their research has led to the establishment of entirely new industries in other fields.

So I do not come to you as an expert on H.R. 5158. It does not deal explicitly with Bell Laboratories, although, as you have heard, some people are making certain implications about the nature of its impact. I realize that limitations of our language make it difficult for those who draft such legislation to state in words the full intent they would like to convey. So we have merely some implications with which we have some concerns. Some of these are the same as have been identified by Bell Laboratories, and if they are inherent in this bill, then we think it is important to take another look at the bill's wording to see whether it needs modification.

It has been stated by some that this bill will make funding of research in the Laboratories more difficult. We would like to inquire whether it will be the effect of the bill that A.T. & T.'s regulated transmission subsidiary will be prohibited from funding basic or undirected research at the Bell Laboratories. It is implicit from the wording of H.R. 5158 that any R. & D. funding by the regulated portion must be shown to benefit directly those activities.

Furthermore, such research and development must be covered specifically by a contract. Now, it is my understanding that this is not much different from the way research has been undertaken in the laboratories in the past. But the overtone in the wording of the bill indicates that it might have an inhibiting effect on this funding.

Because the outcome of research is so unpredictable, it may be difficult to define a direct benefit. So the matter of funding of research may be a concern.

The second potential problem concerns the flow of information. Will the bill have the effect of inhibiting, or even preventing, the free flow of information between all elements which now comprise the Bell System? If this is the case, it will be more difficult for the Bell Laboratories to visualize problems from a systems point of view, and their effectiveness in attacking these problems might be impaired.

We are concerned with this question because the free flow of information may be hindered by the requirement in the bill that Bell's carrier subsidiary deal with other components on an arm's-length basis.

I appreciate this opportunity to testify before this committee. I am here to express the support of the IEEE in seeing Bell Laboratories go forward as a strong and thriving element in the research and development community of this Nation, and if there are provisions in H.R. 5158 which would tend to diminish the effectiveness of those laboratories, we respectfully suggest that they be reexamined.

Thank you.

[The prepared statement of Dr. Damon follow:]

THE INSTITUTE OF
ELECTRICAL AND
ELECTRONICS
ENGINEERS, INC.
UNITED STATES ACTIVITIES BOARD

STATEMENT OF

DR. RICHARD W. DAMON
1981 PRESIDENT

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

ON

THE TELECOMMUNICATIONS ACT OF 1982
AND THE
IMPACT ON THE BELL LABORATORIES

JUNE 9. 1982

Best Available Copy

TESTIMONY BEFORE

HOUSE SCIENCE & TECHNOLOGY COMMITTEE

June 9, 1982

I am Richard W. Damon and I am the Immediate Past President of the Institute of Electrical and Electronics Engineers (IEEE). IEEE is a member society of approximately 160,000 electrical and electronics engineers in the United States and about 220,000 members worldwide. Our membership in the United States includes engineers from government, from industry, and from academia. We are therefore deeply interested in the health and growth of the electrical and electronics industry in the United States and the opportunities which are made available to our members as professional employees, as entrepreneurs, as educators, and in related endeavors. We have many members who are directly concerned with the communications industry and who are thus interested, on one side or the other, in the outcome of the matters pending in the Congress and in the courts, which relate to the telecommunications industry and more specifically, the American Telephone and Telegraph Company (AT&T).

Some of our members regard the thrust of such proposals as a forerunner to destruction, or at best, the degradation of the finest telephone and communication system on earth. Others of our members regard such proposals as an avenue for promoting greater competition, improving efficiency, increasing innovation and providing more opportunities for new businesses.

Because we have members who have an interest in each side of the proposals, it has been difficult for us to adopt a clear and unequivocal stance on the broad issues pertaining to divestiture within AT&T. However, on the issue of perserving and sustaining strong Bell Laboratories, our membership, by and large,

is not divided. I believe I am safe in saying that most of our members regard the Bell Telephone Laboratories as an essential element, a national resource, whose health and vitality must be nurtured and preserved to continue further fundamental research, applied research and engineering development. The outstanding R&D accomplishments of the laboratory have been instrumental in creating a system of communications which is the envy of the world and, indeed, some of their research has led to the establishment of new industries in other fields.

The scientific and engineering achievements of the Bell Laboratories have been exceptional in numbers and in importance. Their own "History of Engineering and Science in the Bell Laboratories", published in 1978 is an excellent account of those achievements in the fields of microwaves, semi-conductors, digital communications, radar, satellites, missiles and atomic weapons, some of these developments having occured under contracts with our government. Perhaps the most significant development which leaps to mind is that of the transistor. The revolution which it inspired in the field of engineering development in some instances, resulted in the creation of whole new industries for our nation.

I do not come to you today as an expert on H.R. 5158. H.R. 5158 does not deal explicitly with the Bell Telephone Laboratories and hence, the impact of that bill on the laboratories must be inferred. I have read those portions of the bill which seem to have an impact on the laboratories. I realize that the limitations of our language make it difficult for those who draft legislation to state in words, the full intent which they would like to convey. Hence, the interpretations of that intent can vary.

Having said this, I wish to make it clear that I am here to comment on concerns which I understand the Bell Laboratories, themselves, have identified as arising from H.R. 5158. If indeed, these problems are inherent in H.R. 5158, we think it important that another look be taken at the bill's wording to see whether modifications are needed.

It has been stated by some that H.R. 5158 will make funding of research in the laboratories more difficult. We would like to inquire whether it will be the effect of the bill that AT&T's regulated transmission subsidiary will be prohibited from funding basic or undirected research at the Bell Laboratories? Implicit from the wording of H.R. 5158 is that any research or development funding by the regulated portion must be shown to benefit, directly, those activities. Furthermore, such research and development must be covered specifically by a contract. It may be said that this is not much different from the way research has been undertaken at the laboratories in the past. But is there an overtone in the wording of the bill that might have an inhibiting effect on the funding? The outcome of research is so unpredictable that a showing of direct benefit may be difficult to define. Thus, the matter of the funding of research at the Bell Laboratories may be a concern.

The second potential problem for the Bell Telephone Laboratories concerns flows of information. Will H.R. 5158 have the effect of inhibiting, or even preventing, the free flow of information between all of the elements which now comprise the Bell System? If such is the case, it may be more difficult for the Bell Laboratories to visualize problems from a systems point of view and, if so, their effectiveness in attacking such problems might be impaired. Our concern

with the question of this free flow of information is occasioned by the requirement stated in H.R. 5158 that Bell's carrier subsidiary deal with the other components on an arm's length basis. While the purpose of providing such language is understood, we ask whether it will impede the most effective interactions between the Bell Laboratories and other elements of the system?

We appreciate this opportunity to testify before this committee. I reiterate that my purpose in being here today is to express the support of the IEEE in seeing the Bell Telephone Laboratories go forward as a strong and thriving element in the research and development community of this nation. If there are provisions of H.R. 5158 which would tend to diminish the effectiveness of those laboratories, we respectfully suggest that they be reexamined.

DR. RICHARD W. DAMON

1981 PRESIDENT

THE INSTITUTE OF ELECTRICAL AND

ELECTRONICS ENGINEERS

Dr. Richard W. Damon is Director of Technology at the Sperry Research Center, Sudbury, Mass.

Dr. Damon joined the Sperry Research Center in 1962 as a staff member. From 1970 to 1982, he was Director of the Applied Physics Laboratory, one of four scientific laboratories at the Research Center. During 1981, Dr. Damon served as President of the Institute of Electrical and Electronics Engineers, Inc. (IEEE). The IEEE is the world's largest technical professional organization, with over 220,000 members in 106 countries.

Dr. Damon received the B.S., M.A. and Ph.D degrees in Applied Physics from Harvard University. Before joining Sperry, he was a Visiting Lecturer at Harvard University, a department head at Microwave Associates, a research associate at the General Electric Research Laboratory and an engineer at Raytheon Company.

Dr. Damon is author or co-author of more than 60 publications and presentations and holds six patents. He is a Fellow of the IEEE and The American Physical Society. He is a member of the IEEE Board of Directors and its Executive Committee. Since 1966 Dr. Damon has been a member or chairman of several Government advisory committees, providing technical advice to NASA, the National Bureau of Standards and the Under Secretary of Defense for Research and Engineering. He is currently a member of the external advisory committee to the Laboratory for Surface Science and Technology, University of Maine, and a Director of the Valpey-Fisher Corporation.

Dr. Damon and his family reside in Concord, Massachusetts.

Mr. FUQUA. Thank you, Dr. Damon.

You mention in your testimony, and maybe you could elaborate, in regard to the exchange of technical information that has been going with Bell Labs, they have exchanged information with other parts of the telecommunications industry, if I am correct.

Do you think, because of the new competitive nature of A.T. & T. and Western Electric, that that might be impeded under that type of an arrangement, both in the consent decree and maybe in the bill?

Dr. DAMON. Well, Mr. Chairman, I have spent my career working for companies which are in some measure competitors of Bell Laboratories. I have hundreds of friends at Bell Labs. We have had, in general, a very open relationship. I have learned from them of advances in technology and of not just the details as they are published in papers but the understanding that is essentially the invisible college of research people. I have gotten that as an employee at GE, at Sperry, where I am now employed, and at other companies.

To me it is inconceivable that the competitive portion of Bell Laboratories can continue to be so open. I mean, I have equally fine friends in other companies that are competitors of ours. We respect one another's competitive position, and we simply cannot be similarly open.

So I am afraid that that part of it will certainly be hindered. There will be such research as that done by Dr. Penzias, for example, that will certainly go to the open market, but I think developments in areas such as bubble memories, some semiconductor work, concepts for computers will necessarily be much more restricted by the reorganized Bell Laboratories.

Mr. FUQUA. Do you think, in the competitive environment, that the A.T. & T. management would likely allow Bell Labs to continue with its substantial program of basic research?

Dr. DAMON. I think that Bell Labs or A.T. & T. will instantly be a very large corporation and a formidable competitor. It will be of a size that they could afford a large degree of basic research. I think it will not be of the same scale as it has been able to have under the regulated body.

But the areas of interest, I think, will probably change somewhat. I think their time horizon for their return on their investment will change somewhat, as is necessary in all competitive organizations, but I am confident there will continue to be a lot of good research supported, as there is in some other large corporations. I cite General Electric and IBM as example.

Mr. FUQUA. Do you see—I asked a similar question to Dr. Gibbons—that they may also seek more Federal funds for some of their basic research activities?

Dr. DAMON. Well, that will be a corporate decision, and you know better than I that requests for increased Federal support for funds is almost never ending, and I think that there should be perhaps greater Federal support of basic research beyond our present level, and it would be a sound investment.

The basic research at Bell Labs is a small fraction of all basic research in this country, although it is a significant fraction of telecommunications research. In many respects, I am less concerned as

to whether or not they come to you for money, which may be a few tens of millions of dollars at the outside, I am less concerned about the money that may be spent than I am of the possibility of destroying the creative environment at Bell Laboratories which has been shown to be capable of performing such excellent research.

I think it is the freedom they have had, and the flexibility, and the ability to do end-to-end systems planning that has been their great strength, and the money is almost beside the point.

Mr. FUQUA. Do you see their emphasis being modified to produce or to have a more vigorous product development program?

Dr. DAMON. I would say very definitely. They certainly have the technical skills, and in fact they probably have some products that are already highly competitive in the open market, and I think that they will take advantage of it and they will instantly be a very formidable competitor not only in telecommunications but data processing and other areas of the computer industry.

Mr. FUQUA. Do you think the basic research that could be funded from the operating companies through their rate base and also through the long lines would give Bell Labs or A.T. & T. an unfair competitive advantage over other research? I am really speaking of basic research here.

Dr. DAMON. I understand.

Mr. FUQUA. And if in fact it is somewhat restricted in the flow of information that we talked about, which, I agree with you, I think it is very essential that we try to maintain that free flow of information, particularly for basic research.

Dr. DAMON. Yes; now, that is a serious concern. I would hope that the Bell operating companies would still find it worthwhile to support their share of the basic research at Bell Labs. They have contributed significantly to it, and presumably, if it has been allowed into their rate base, they must have benefited from it.

Unfortunately, there will now be 23 managements instead of one making the decision to put the money in. But I hope they can continue.

Mr. FUQUA. But I think, in the operating companies, that the regulators, public service commissions, would be sympathetic as they have been in other areas.

Dr. DAMON. I would hope so.

Mr. FUQUA. I mentioned EPRI and GRI.

Dr. DAMON. That is right. I would think that an EPRI-like organization would be very beneficial for those operating companies.

Now, you asked whether that would allow the basic research to go on and whether that would give an unfair advantage to their competitive activities. Speaking as an employee of one of their competitors, I can see that they would have a great benefit, and I guess I would hope that they would continue to be open in their publication and dissemination of the information that is derived out of their monopoly base so that the rest of us have an opportunity to learn that information, obviously not as quickly as those in the developmental portions of Bell Labs, but at least with some degree of fairness.

Mr. FUQUA. Would it be possible for Bell Labs or a lab of that type—I am not saying the amount, but——

Dr. DAMON. They are unique.

Mr. FUQUA. They are unique—to be able to conduct basic research that could be funded by regulated industries, the operating companies and the long lines, and at the same time engage in product development that would be funded by the nonregulated part, but to be open and to have this exchange of scientific information? I am really speaking of the basic research area. I don't know if I am making my question very clear or not.

Dr. DAMON. Yes; I understand the question.

Mr. FUQUA. I am greatly concerned that we do not close this avenue of communication and have a block so that basic research is still only conducted in-house and not made available for the communications industry.

Dr. DAMON. Well, I stated I would hope that that information would be publicly disseminated, and I think it should be publicly disseminated since it is paid for from the rate base. Insofar as that is the case, I think the bill includes specific contracts for research that is to be supported by the rate base. Those programs in particular should have rapid publication, rapid presentation at conferences, and should become essentially public information.

As I said, I think that the people within Bell Labs doing product development, just because of their proximity, will have a natural advantage, but one cannot have everything.

Mr. FUQUA. Dr. Penzias mentioned section 251(c)(5), which in effect says there shall not have any effect of assigning or allocating the cost of any research. Maybe between the words "any" and "research" we may put the word "applied."

Dr. DAMON. Something of that nature.

Mr. FUQUA. It may clarify the intent that basic research could still be carried on.

Dr. DAMON. I would hope that would be the case.

Mr. FUQUA. Applied would mean possibly product development.

Dr. DAMON. Yes; because their basic research has been extraordinarily productive, not only in telecommunications, in materials, in electronics, semiconductor electronics, and so forth. We would lose a great resource if we cannot have that.

Mr. FUQUA. Dr. Damon, thank you very much for being here and for your organization's statement.

Dr. DAMON. Thank you.

Mr. FUQUA. I want to thank all of the witnesses for responding on rather short notice for these hearings. I think they have been very productive, and I again thank them for being here and for their participation.

[Whereupon, at 11:54 a.m., the committee recessed, to reconvene at the call of the Chair.]

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